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BULLETIN No. 49.

U. S. DEPARTMENT OF AGRICULTURE
OFFICE OF EXPERIMENT STATIONS

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PROCEEDINGS

OF THE

ELEVENTH ANNUAL CONVENTION

OF THE ASSOCIATION OF

American Agricultural Colleges and Experiment Stations

HELD AT

MINNEAPOLIS, MINN., JULY 13–15, 1897

EDITED BY

A. C. TRUE, for the Office of Experiment Stations

AND

H. H. GOODELL, for the Executive Committee of the Association

WASHINGTON
GOVERNMENT PRINTING OFFICE
1898

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U. S. DEPARTMENT OF AGRICULTURE.

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* Director.
† President of board of direction.
‡ Assistant director in charge.
§ Chairman of council.
‖ Secretary.
¶ Acting director.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., January 15, 1898.

SIR: I have the honor to transmit herewith for publication Bulletin No. 49 of this Office, containing the proceedings of the Eleventh Annual Convention of the Association of American Agricultural Colleges and Experiment Stations, held at Minneapolis, Minn., July 13–15, 1897.

The stenographic report of the proceedings was made by Mr. R. M. Reese, of this Department.

Respectfully,

A. C. TRUE,
Director.

Hon. JAMES WILSON,
Secretary of Agriculture.

OFFICERS AND COMMITTEES OF THE ASSOCIATION.

President:

H. C. WHITE, of Georgia.

Vice-Presidents:

ALSTON ELLIS, of Colorado; S. M. EMERY, of Montana;
W. M. LIGGETT, of Minnesota; C. S. PLUMB, of Indiana;
E. W. HILGARD, of California.

Secretary and Treasurer:

E. B. VOORHEES, of New Jersey.

Executive Committee:

H. H. GOODELL, of Mass., *Chairman;* J. H. WASHBURN, of Rhode Island;
ALEXIS COPE, of Ohio; R. H. JESSE, of Missouri;
Ex officio: The President; the Junior Ex-President (G. T. FAIRCHILD); the Secretary.

Bibliographer:

A. C. TRUE, of Washington, D. C.

OFFICERS OF SECTIONS.

Agriculture and Chemistry:

R. J. REDDING, of Ga., *Chairman;* C. D. SMITH, of Mich., *Vice-Chairman;*
T. L. HAECKER, of Minn., *Secretary.*

Botany and Horticulture:

S. T. MAYNARD, of Mass., *Chairman;* H. L. RUSSELL, of Wis., *Secretary.*

College Work:

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E. A. BRYAN, of Wash., *Secretary.*

Entomology:

J. B. SMITH, of N. J., *Chairman;* C. M. WEED, of N. H., *Secretary.*

Mechanic Arts:

W. S. ALDRICH, of W. Va., *Chairman;* A. J. WIECHARDT, of Mo., *Vice-Chairman;*
F. P. ANDERSON, of Ky., *Secretary.*

COMMITTEES.

Indexing Agricultural Literature:

A. C. TRUE, of Washington, D. C., *Chair.;* T. F. HUNT, of Ohio;
W. M. HAYS, of Minnesota; E. DAVENPORT, of Illinois;
W. P. CUTTER, Librarian U. S. Dept. of Agriculture.

Methods of Teaching Agriculture:

J. H. CONNELL, of Texas, *Chairman;* A. C. TRUE, of Washington, D. C.;
T. F. HUNT, of Ohio; H. T. FRENCH, of Oregon;
H. H. WING, of New York.

Engineering Experiment Stations:

C. S. MURKLAND, of N. H., *Chairman;* M. H. BUCKHAM, of Vermont;
F. P. ANDERSON, of Kentucky; A. W. HARRIS, of Maine;
J. E. STUBBS, of Nevada.

Nomenclature:

H. P. ARMSBY, of Penn., *Chairman;* C. M. WEED, of New Hampshire;
E. H. JENKINS, of Connecticut; E. S. GOFF, of Wisconsin;
A. C. TRUE, of Washington, D. C.

Graduate Study at Washington:

C. NORTHROP, of Minnesota, *Chairman;* G. E. MACLEAN, of Nebraska;
ALSTON ELLIS, of Colorado; ALEXIS COPE, of Ohio;
M. H. BUCKHAM, of Vermont; J. H. WASHBURN, of Rhode Island.

Collective Station Exhibit at Paris Exposition:

H. P. ARMSBY, of Penn., *Chairman;* A. W. HARRIS, of Maine;
W. H. JORDAN, of New York; M. A. SCOVELL, of Kentucky;
A. C. TRUE, of Washington, D. C.

Uniform Fertilizer Laws:

H. J. WHEELER, of R. I., *Chairman;* H. P. ARMSBY, of Pennsylvania;
C. D. WOODS, of Maine; E. H. JENKINS, of Connecticut;
M. A. SCOVELL, of Kentucky.

LIST OF DELEGATES AND VISITORS IN ATTENDANCE.

Arizona:

College: H. Billman, president; R. H. Forbes, professor of chemistry.
Station: W. S. Devol, director, agriculturist and horticulturist.

Arkansas:

College: J. T. Stinson, professor of horticulture.

California:

College: R. H. Loughridge, assistant professor of agricultural geology and agricultural chemistry.

Colorado:

College: A. Ellis, president.

Connecticut:

College (Storrs): B. F. Koons, president.

Delaware:

College: G. A. Harter, president.

Florida:

College: O. Clute, president.

Georgia:

College: H. C. White, president.
Station: R. J. Redding, director; H. N. Starnes, horticulturist.

Iowa:

College: J. B. Weems, professor of agricultural chemistry.
Station: C. F. Curtiss, director; J. W. Wilson.

Kansas:

College: G. T. Fairchild, president; T. E. Will.
Station: S. C. Mason, horticulturist.

Kentucky:

College: F. P. Anderson, professor of mechanical engineering.
Station: M. A. Scovell, director.

Maine:

College: A. W. Harris, president.
Station: W. M. Munson, horticulturist.

Massachusetts:

College: H. H. Goodell, president; S. T. Maynard, professor of horticulture.

Michigan:

College: J. L. Snyder, president.
Station: C. D. Smith, director; C. F. Wheeler, botanist.

Minnesota:

College: C. Northrop, president; C. W. Hall, dean of college of engineering, metallurgy, and mechanic arts; S. B. Green, professor of horticulture; H. W. Brewster, professor of mathematics; H. Snyder, professor of agricultural chemistry; W. M. Hays, professor of agriculture; M. H. Reynolds, professor of veterinary medicine and surgery; T. Shaw, professor of animal husbandry; D. W. Sprague, accountant.
Station: W. M. Liggett, director; T. L. Haecker, dairy husbandry; J. A. Hummel, assistant chemist; T. A. Hoverstad, assistant agriculturist at Crookston; A. Boss, assistant agriculturist at university farm; R. S. Mackintosh, assistant horticulturist; J. A. Vye, secretary.

Mississippi:

College: A. J. Wiechardt, professor of mechanic arts.
Station: W. L. Hutchinson, director.

Missouri:

College: R. H. Jesse, president.
Station: H. J. Waters, director.

Montana:

Station: S. M. Emery, director.

Nebraska:

College: G. E. MacLean, chancellor; C. R. Richards, professor of practical mechanics; T. L. Lyon, associate professor of agriculture.
Station: A. T. Peters, investigator of animal diseases.

Nevada:

College: J. E. Stubbs, president.

New Hampshire:

College: C. S. Murkland, president.

New Jersey:

Station: E. B. Voorhees, director.

New Mexico:

College: J. P. Owen, vice-president and professor of history and political science.
Station: C. T. Jordan, director; R. Black, regent.

New York:

Station (Ithaca): I. P. Roberts, director.
Station (Geneva): W. H. Jordan, director; S. A. Beach, horticulturist.

North Carolina:

College: F. E. Emery, professor of agriculture.

North Dakota:

College: J. H. Worst, president; J. H. Shepperd, professor of agriculture; H. L. Bolley, professor of botany and zoology.
Station: T. D. Hinebauch, veterinarian.

Ohio:

College: J. H. Canfield, president; W. R. Lazenby, professor of horticulture and forestry; T. F. Hunt, professor of agriculture; A. Cope, secretary board of trustees.
Station: C. E. Thorne, director; J. T. Robinson, trustee.

Oregon:

College: U. P. Hedrick, professor of horticulture and botany.
Station: F. L. Kent, assistant agriculturist and dairy instructor.

Rhode Island:

College: J. H. Washburn, president; A. A. Brigham, professor of agriculture.
Station: C. O. Flagg, director.

South Carolina:

College: E. B. Craighead, president; W. E. A. Wyman, professor of veterinary science.
Station: W. J. Quick, vice-director and agriculturist.

South Dakota:

College: J. W. Heston, president; E. A. Burnett, professor of agriculture and animal husbandry.
Station: J. H. Shepard, director; Dice McLaren, entomologist.

Texas:

College: A. M. Soule, assistant professor of agriculture.
Station: J. H. Connell, director.

Utah:

College: J. M. Tanner, president.

Vermont:

College: M. H. Buckham, president.

Station: L. R. Jones, botanist.

Washington:

College: W. J. Spillman, professor of agriculture; W. H. Heileman, assistant professor of chemistry.

Station: E. A. Bryan, director.

West Virginia:

College: L. C. Corbett, professor of agriculture and horticulture; W. S. Aldrich, professor of mechanical engineering.

Station: J. A. Myers, director; A. D. Hopkins, entomologist and vice-director.

Wisconsin:

College: G. McKerrow, superintendent farmers' institutes.

Station: W. A. Henry, director; E. S. Goff, horticulturist; H. L. Russell, bacteriologist.

Wyoming:

College: F. P. Graves, president.

Station: B. C. Buffum, agriculturist and horticulturist.

U. S. Department of Agriculture:

Office of Experiment Stations: A. C. True, director; E. W. Allen, assistant director; R. M. Reese.

Division of Botany: G. H. Hicks.

Division of Chemistry: H. W. Wiley, chief.

Canada:

Ontario Agricultural College: C. A. Zavitz.

England:

Rothamsted: Henry E. Armstrong.

Visitors:

L. B. Bassett, C. P. Berkey, William Boss, C. P. Bull, R. H. Burns, W. L. Carlyle, E. A. Cuzner, E. N. Disney, J. M. Drew, W. W. Folwell, E. B. Forbes, J. H. Gill, O. C. Gregg, A. E. Haynes, B. von Herff, W. R. Hoag, F. P. Leavenworth, T. G. Lee, E. E. McDermott, D. G. McGinnis, Francis Ramaley, F. L. Ransom, G. Shepardson, W. G. Smith, H. O. Storkness, J. E. Stephens, A. E. Stine, F. W. Taylor, A. G. Wilcox.

PROCEEDINGS.

Morning Session, Tuesday, July 13, 1897.

The convention was called to order at 9.30 a. m. by President G. T. Fairchild, of Kansas, and after prayer, offered by J. E. Stubbs, of Nevada, a short address of welcome was made by President C. Northrop, of the University of Minnesota, who placed all the buildings and facilities of the university at the disposal of the convention and cordially invited the members, delegates, and visitors to an informal reception at his residence on Thursday evening, July 15, after the close of the convention. Upon motion by H. H. Goodell, of Massachusetts, this invitation was accepted by a unanimous vote.

The chairman of the executive committee then read the report of that committee, as follows:

Report of the Executive Committee.

Immediately following adjournment of the tenth annual convention of this Association the new executive committee met and organized for the year, with H. H. Goodell chairman, and J. H. Washburn secretary.

The various matters referred to it for action have received due attention and, as far as possible, been pressed to completion. The resolution urging upon Congress the importance of an early adoption of the metric system of weights and measures as the legal standard for the United States was transmitted to the Chairman of the Committee on Weights and Measures, and by him incorporated in his report.

The report of the committee to which was referred the codification of the "resolutions and declarations of previous meetings of this Association concerning uniformity in action on the part of colleges and stations in matters of common interest," and to which has been added all supplementary matter passed since the report was made, has been put in print and is now before you. The executive committee recommends its adoption and that it be printed with the constitution, to the end that all rules, by-laws, and resolutions affecting the interests of this Association may be brought together in a single pamphlet for ready reference and permanent preservation.

To your committee was referred also the transmission to the Secretary of Agriculture of a series of resolutions urging a revision of the Handbook of Experiment Station Work, which should include the work of the Department and the preparation of an index to the publications of the Department. In reply to a communication accompanying these resolutions, every assurance was given that the value of the work was appreciated and that said revision and preparation of index would be undertaken at once, the latter, as being in its nature prefatory, first.

A resolution recommending that the publications of each station for the year be paged consecutively, and that there be appended to the annual report or final publication for the year a title-page and an alphabetical index of subjects, was referred to the executive committee, with instructions to give the subject as full consideration as possible and to make report at the next annual convention. Pursuant to instructions, a circular was sent to the director of each station asking whether such paging, with title-page and index, was practicable. Forty replies were received, and a far greater uniformity of custom found than was expected. Eighteen replied that they either wholly or in part already conformed to the recommendations submitted in the resolution; fourteen either distinctly favored them or said there was nothing to hinder their adoption. Only eight declared themselves adverse, for the following several reasons: Storrs, New Haven, and New Jersey did not consider it necessary to page their bulletins consecutively, because they were incorporated in their annual report; Indiana, Massachusetts, and Geneva found a practical difficulty in the fact that the bulletins were printed at their stations, while the annual report was printed by the State printer; Delaware saw no necessity for such action, while

Pennsylvania reported that, though not impracticable, it would be inconvenient. With their present more accurate knowledge of conditions at the several stations, and finding so large a percentage in favor of the resolution, your committee are inclined to report it back without change and recommend its adoption.

The free homestead bill (Senate 372) has been a source of much anxiety to your committee. It provides that "all settlers under the homestead laws of the United States upon the public lands acquired prior to the passage of the act by treaty or agreement from the various Indian tribes, or upon military reservations which have been opened to settlement, who have or who shall hereafter reside upon the tract entered in good faith for the period required by existing law, shall be entitled to a patent for the land so entered upon the payment to the local land officers of the usual and customary fees, and no other or further charge of any kind whatsoever shall be required from such settler to entitle him to a patent for the land covered by his entry." In other words, the bill proposes to remit $35,000,000 due the United States for lands sold to settlers and which they had asked the privilege of buying. The income from the sale of public lands, upon which the Morrill annuity to the colleges depends, will be lessened by just this amount if the bill passes. Information has been received that this source of supply for our colleges will soon give out if this gift of $35,000,000, a sum sufficient for their maintenance for twenty-nine years, is made to the Western settlers. If this bill passes it cripples the means for educating the industrial classes throughout the whole United States, while it makes a free gift of land in a few States and Territories. Passed in the Senate by a very strong majority, it has been referred in the House to the Committee on the Public Lands. Its friends have thus far been unsuccessful in bringing it to a vote, but they will undoubtedly succeed in the next session if strong effort be not made to clearly explain the effect of its passage.

The recommendation of the Inspector-General of the Army, in his report for 1892, that such legislation be had as will enable the Secretary of War to supply the military departments of the land-grant colleges with the necessary uniforms for their cadets, seems nearer realization at the present time than ever before, and your committee strongly recommends a renewal of the action authorized by the conventions of 1893 and 1894.

The numerous details attendant upon furnishing such colleges as desired with a bust of the Hon. Justin S. Morrill, of Vermont, have been successfully carried out, and the secretary will make final report of the action taken.

In conclusion we would state that the usual duties devolving upon the committee have been faithfully performed. The proceedings of the last convention have been edited and published; the various papers recommended by the committee appointed for that purpose have been published; and the customary notices, programmes, etc., have been issued.

In behalf of the executive committee.

H. H. Goodell, *Chairman.*

Mr. Goodell gave notice that later in the proceedings he would call up the two or three recommendations contained in the report and move their adoption. He deferred this action for the present in order not to delay the regular business order.

The president then called for the report of the treasurer, which was submitted by J. H. Washburn, of Rhode Island, as follows:

Report of Treasurer of the Association for the Year ending July 13, 1897.

Amount on hand from 1896	$475.45
Amount received from dues	910.00
Total	1,385.45
Amount paid for bills on approval of chairman of the executive committee	966.87
Balance	418.58

The chair appointed an auditing committee, consisting of C. D. Smith, of Michigan; S. T. Maynard, of Massachusetts, and T. F. Hunt, of Ohio, which later made the following report, which was accepted:

Your committee appointed to audit the treasurer's accounts begs leave to report that it has examined the same and finds them correct, with properly approved vouchers for each item of expenditure, and finds that there is a balance on hand of $418.58.

C. D. Smith,
S. T. Maynard,
Thomas F. Hunt,
Committee.

Mr. Goodell read the report of the chairman of the Section on Horticulture and Botany, P. H. Mell, of Alabama, who was not present. The report follows:

Report of the Section on Horticulture and Botany.

That portion of the constitution relating to the duties of officers states that "the chairman of each section shall make at the annual convention a report to the Association in general session of the progress during the preceding year of the subject or subjects appertaining to his section." In attempting to carry out the provisions of this article the writer addressed a circular letter to each of the botanists and horticulturists in the United States who are entitled to representation in this Association, requesting information on the subjects under consideration. Some of the workers gave prompt response, while a number of others failed to give the slightest evidence that the circular had ever been received.

A report of this character can be of little value without the hearty cooperation of a large majority of the botanists and horticulturists concerned, but the writer is compelled to admit that for lack of interest, or for other reasons, only thirty-one stations out of fifty in the United States replied to the circular letter for information, and even in the case of some of the replies sent in the information was so meager that but little assistance was rendered by them in the preparation of this report. It may be stated as a parenthetical clause that if these reports are to be continued in the future it will be wise to devise some plan by which the workers at the various stations can be made to see the importance of answering fully and freely the questions propounded to them by the chairmen of sections.

For the reasons stated, nothing but general conclusions will be presented to the session in this résumé of the work of the botanists and horticulturists.

According to the "Organization lists of the agricultural experiment stations,"[1] there are 39 botanists and 11 assistants and 61 horticulturists and 18 assistants connected with the stations, making 129 workers. Twenty-seven of these are also engaged in other duties, such as chemistry, agriculture, so-called biology, entomology, etc. There are 19 botanists, horticulturists, and assistants who are not engaged in station work, but their time is devoted to college duties alone. Nearly, if not quite, all of the 129 experimenters are also engaged in teaching in the colleges or universities to which the stations are connected. It is legitimate, therefore, to divide this report into work relating to (1) college duties and (2) station experiments.

COLLEGE DUTIES.

The colleges as a rule are giving a fair proportion of time to the study of botany and horticulture, and it is gratifying to notice the rapid extension the courses are taking and the success the teachers are meeting with in enlarging the work and giving dignity and importance to the subjects. The average attendance of students in each State during the past session was in botany 85 and in horticulture 20; the maximum reported in botany being 325 and the minimum 8; the maximum in horticulture was 94 and the minimum 1. The number of post-graduate students ranged from 1 to 12 in botany and 1 to 3 in horticulture. The Indiana college makes the following statement in regard to post-graduates in botany: "The investigations during post-graduate study are usually valuable contributions to science, and are generally published in standard journals."

The facilities at the command of the students in these land-grant colleges have been greatly increased during the year, and in many of these institutions the appliances for study and investigation have been multiplied to a gratifying degree. Nearly every college of note has a botanical laboratory, equipped with first-class compound miscroscopes, with an adequate outfit of apparatus for satisfactory investigations in histology. Some of these laboratories have also apparatus for advanced work in physiological botany. The following institutions report more or less advanced work in this important branch of botany: Alabama, Florida, Indiana, Massachusetts, Nebraska, New York (Cornell), North Dakota, South Dakota, and Vermont. This tendency toward physiological investigation in our colleges is important and gratifying.

The following States have greenhouses and the appliances necessary to equip the same:

	Square feet.
Alabama, 2 greenhouses	2,500
Florida, 1 greenhouse	1,680
Georgia, 1 greenhouse	640
Indiana	.....
Kentucky, 4 greenhouses	3,000

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 39.

	Square feet.
Massachusetts (Amherst)	1,000
Missouri, 4 greenhouses	3,300
Nebraska	3,000
New Hampshire, 2 greenhouses	3,300
New Jersey, 3 greenhouses	2,280
New Mexico (number of square feet not given)	-----
New York (Cornell), "1 building with 5 houses"	-----
New York (Geneva)	3,840
North Carolina, 5 greenhouses	3,200
North Dakota, "small greenhouse"	-----
Ohio, 1 greenhouse	450
Oregon, 3 greenhouses	2,800
South Carolina, 2 greenhouses	1,584
South Dakota, 3 greenhouses	2,200
Tennessee, 1 greenhouse	1,480
Virginia, 2 greenhouses	1,650
Vermont, 1 greenhouse	1,600
Washington (no dimensions given)	-----
West Virginia, 3 greenhouses	2,460
Wisconsin, 2 greenhouses	3,300

With this extensive greenhouse plant the students in horticulture have special advantages for advanced work in plant growth and economic botany. The rapidly increasing number of students who are availing themselves of these excellent facilities in the departments of botany and horticulture indicates that many of the young men of the country are adopting agriculture and the allied sciences as their professions.

STATION EXPERIMENTS.

The reports from the different States show that there is a wide range of topics under consideration by the botanists and horticulturists, and many of the results will be of more than local interest and importance. The activity manifested by these workers is generally directed systematically to the solution of problems of more or less local interest. This is all very well, but it seems to the writer that much good could be accomplished if some of the problems of general interest to great sections of the country were taken under consideration by groups of botanists or horticulturists in the same systematic manner adopted by the General Government in the study of food products, etc. Such topics as improvement of seeds; diseases of plants, such as the corn, cotton, wheat, etc.; improvement of native plants for food; selection and improvement of corn, and improvement of cotton are of general interest to large portions of the United States, and systematic work on the subjects by a number of the experimenters, under direction of preconcerted plans, will yield large and valuable results.

The reports received by the writer indicate that the following subjects are now controlling the attention of the botanists at the stations:

(1) Study of the wild plants of State, and in some instances a botanical survey is under way—Alabama, Arkansas, Nebraska, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, South Carolina, South Dakota, Tennessee, Washington, and West Virginia.

(2) Crossing and hybridizing—Alabama, Georgia, New Hampshire, North Carolina, South Carolina, and Vermont.

(3) Improvement of seeds—Alabama, Indiana, New Hampshire, North Carolina, South Carolina, Texas, Virginia, Wisconsin, Washington, and West Virginia.

(4) Diseases of plants—Alabama, Indiana, Nebraska, New Hampshire, New York (Cornell and Geneva), North Carolina, Ohio, Oregon, Texas, and Virginia.

(5) Study of weeds—Kansas, New Jersey, Ohio, Oregon, and Vermont.

(6) Study of native grasses—Alabama, Kansas, and Massachusetts.

(7) Fiber plants—North Carolina.

(8) Plants poisonous to cattle—Oregon and South Carolina.

(9) Experiments on foreign seeds—Alabama, Florida, Georgia, Idaho, Indiana, Iowa, New Hampshire, North Carolina, Ohio, Oklahoma, Oregon, South Dakota, Texas, and Virginia.

(10) Vegetable pathology—Vermont.

The horticulturists report the consideration of the following topics:

(1) Studies on leading fruits and orchard cultivation—Alabama, Florida, Oregon, South Dakota, Tennessee, Texas, Vermont, and Wisconsin.

(2) Improvement of native huckleberry—Georgia.

(3) Varietal tests—Indiana and West Virginia.

(4) Greenhouse culture of lettuce—Indiana and Tennessee.

(5) Winter protection of buds—Missouri.
(6) Position of bud influencing tree—Indiana.
(7) Methods of tree planting—Nebraska.
(8) Selection and breeding of sweet corn—Nebraska.
(9) Pollination and crossing of cucumbers—Nebraska.
(10) Forcing vegetables—New Hampshire, New York (Geneva), North Carolina, and Tennessee.
(11) Experiments with fungicides and spraying—New York and Oregon.
(12) Selection of seed—New York (Geneva) and South Dakota.
(13) Plant nutrition and effects of girdling grapes—New York (Geneva).
(14) Value of various stocks for plum orchards—New York (Geneva).
(15) Culture of selected strain of potatoes—North Dakota.
(16) Storing, shipping, and canning fruits—South Carolina.
(17) Top grafting and improvement of native plants—South Dakota.
(18) Inbreeding of Russian and North European varieties—South Dakota.
(19) Potash salts on yield of potatoes—Virginia.
(20) Preservation of fruits—Vermont.
(21) Pruning of plants—West Virginia.

The number of bulletins issued by the two departments under consideration show considerable activity during the past eight months covered by this report. The botanists issued 23 bulletins aggregating 804 pages, and the horticulturists sent out 41 containing 1,227 pages, or a total of 2,031 pages. The following table gives in detail these facts in reference to the bulletins:

Botanical and horticultural publications issued by the colleges and stations during the eight months ending July 13, 1897.

State.	Botany.		Horticulture.	
	Number of publications.	Pages.	Number of publications.	Pages.
Alabama	2	221	1	27
Arkansas			2	95
Arizona	1	32	1	44
California	1	9		
Delaware	1	22	*a* 1	29
Kansas	1	46		
Iowa	1	36	1	11
Illinois	1	39		
Louisiana	1	16		
Maine	1	8		
Massachusetts	1	32	1	48
Michigan			1	97
Minnesota			2	81
Nebraska			1	28
New Hampshire	1	14	2	26
New Jersey	1	19	1	23
New York (Cornell)	1	20	7	210
New York (Geneva)	2	67	4	102
North Carolina	1	17		
North Dakota	1	57		
Ohio	2	73	2	48
Pennsylvania			1	29
Rhode Island			4	116
South Dakota			2	72
Tennessee	*a* 1	3	3	58
Utah			1	26
Vermont	1	16	2	30
Washington			1	27
Wyoming	1	57		

a Annual report.

These bulletins treat of such subjects as: Crossing; lists of fungi; weeds; diseases of plants; bacteriology of milk; leguminous-root tubercles; electro-germination; spraying experiments; forage and fiber plants; horticultural suggestions; sugar beets; propagation; variety tests of fruits and vegetables; rate of increase on cut-over timber lands; wind-breaks; vegetables; fruits and orchards; sweet peas; dahlias; chrysanthemums; seed tests; pot culture of lettuce; vegetable gardening; forestry, etc.

P. H. Mell, *Chairman.*

The secretary of the Association, J. H. Washburn, read a letter from the Commercial Club of Minneapolis, tendering the convention an excursion to Lake Minne-

tonka on Thursday afternoon, July 15. Upon the statement of the chairman of the executive committee that the section meetings occurring at that time could be otherwise provided for, the Association by a rising vote accepted the invitation of the Commercial Club.

A. D. Hopkins, of West Virginia, read the following report from the Section on Entomology, which was accepted:

Report of the Section on Entomology.

The information at hand is not sufficient to enable me to make a full report of progress during the past year of subjects appertaining to our section, but I can say that the evidence gathered from correspondence and published results indicates that there has been a general advancement in the work, both at the colleges and experiment stations.

PROGRESS IN TEACHING ENTOMOLOGY.

Under the head of progress in teaching entomology I may say that a marked advancement is noted in the adoption of new and up-to-date text and reference books, improved methods of teaching, and in the increased number of entomological students, which in some States, notably in Maine and Missouri, have doubled during the past year. The quite general adoption of Comstock's Manual and Smith's Economic Entomology is an advancement in facilities for teaching entomology and in elevating the departments of entomology in the colleges to a level with that of other departments, which is among the most important since the organization of the agricultural colleges.

PROGRESS IN ENTOMOLOGICAL INVESTIGATIONS.

While the progress in the line of original investigations by the experiment-station entomologists is not all that could be desired, it is gratifying to know that considerable advancement has been made. Especially is this so at the stations where the entomologist has all or a large share of his time to devote to original investigations.

There appears to be an increasing public interest in the entomological work of the stations. This is manifested in the greatly increased demand for information. With increased facilities for giving reliable information, this is in the line of true progress, since it is leading to a more general and intelligent application of the results of scientific research.

While the progress that has been made in the entomological work of the stations in the line of original research is gratifying, it is not what one would be led to expect from the ample facilities found in the thoroughly equipped laboratories, libraries, and men at most of the stations having an entomological department. This lack of progress, it is plain to be seen, is not for the want of subjects demanding investigation, or of suitable men and equipments to carry on the work. In most cases it is due to the limited time and energy available for this class of work. It appears that some so-called experiment-station entomologists are required to devote all of their time and energies to teaching and routine station duties; or it must be divided between a number of distinct departments of both college and station work. As an example of what some entomologists are doing, I will quote from a previous report of a chairman of this section:

"One has entomology, botany, horticulture, landscape gardening, and forestry; another, botany, horticulture, entomology, and general zoology; another, arithmetic, word analysis, physiology, zoology, histology, and entomology; one is vice-director of the station, and is horticulturist, entomologist, and mycologist at the same time."

It is plain that no progress can be made in original investigations when this state of affairs exists. Few persons who are not entomologists realize how important it is for the entomological investigator to devote all of his time to his special lines of work. The complicated problems he has to deal with in working out the obscure features of the life history and habits, even of some of our commonest insect depredators, and in a study of the economic relation of insects to plants and animals, requires an immense amount of time, as it does also in the routine work necessary in collecting and preparing material for study and that involved, in describing and illustrating, distinctive characteristics of the different stages of an insect and its work.

At the West Virginia Station we have had, up to the past college year, all of our time to devote to the regular station duties, with an assistant to do a large share of the routine work, yet we constantly felt the need of more time to devote to our special lines of investigation. The small amount of teaching (one hour a week for the entomologist and two hours a week in economic botany for the assistant entomologist) required of us last year gave us sufficient experience to conclude that life

is too short and time too precious for an experiment-station investigator to devote much of his time to college work or to any other lines of work which are not intimately related to his specialties. There are teachers and there are investigators, and if we would have rapid progress in the subjects pertaining to the duties of both it is evident that the teacher should devote his time to college work, while the investigator should have all of his time to devote to regular station work, and, as much as possible, to original research.

ASSOCIATION WORK IN ENTOMOLOGY.

In the discussion of progress in entomological work it seems desirable that something should be said with reference to the work of the various organizations toward the advancement of the science of entomology, both technical and economic.

The organizations which are contributing to the special advancement of economic entomology are the following: The Association of Economic Entomologists; the American Association of Agricultural Colleges and Experiment Stations through its Section on Entomology and committees dealing with entomological questions; the Society for the Promotion of Agricultural Science in its joint sessions with the Association of Economic Entomologists; also the Entomological Society of Ontario and the Entomological Society of Washington, both of which have many papers and subjects of economic interest presented and discussed at their meetings.

For the special advancement of the science from a technical standpoint the following may be mentioned: The American Association for the Advancement of Science through its Section of Zoology and its Entomological Club; the American Entomological Society and the American Philosophical Society, which, together with the numerous local entomological and natural history societies and academies of science, is about all that could be desired in the facilities offered in this direction.

It is enough to say with reference to progress in entomology as the result of organized effort that a considerable amount of valuable matter has been presented and published during the past year which is of especial value to the etomological teacher and investigator. While we can not review in detail in this report the entomological work of all of the associations, societies, and academies, it seems necessary that we should consider the objects, work, and results of this section and that of the Association of Economic Entomologists, both of which are composed of working or official entomologists.

This section is the outgrowth of a permanent committee on entomology, which was organized November 14, 1889, at the third convention of this Association. The object of the committee, as stated in the constitution, was "the consideration of such subjects as shall become desirable."

The first meeting of the committee was held in connection with the fourth convention of the Association, at Washington, D. C., November 11–12, 1890, and was very successful. Nine papers were read and discussed, and the proceedings, including all of the papers, were published in Insect Life. It appears that no meetings of the section were held at the fifth, sixth, and seventh conventions. At the eighth a meeting was held and four papers presented, and at the ninth convention the section met and discussed seven papers. Full reports of progress in subjects appertaining to the section were read before the general session of the fourth, fifth, sixth, eighth, and ninth conventions of the Association. Thus we find that, up to the tenth, but four regular sessions of the committee and section have been held. Twenty papers have been presented at the section meetings and five reports have been read in general session.

While there has evidently been much good derived from the attendance of these section meetings by working entomologists, it would appear from the title of papers presented that there has never been a very definite object pursued, and we find but few recorded results or published papers, except in the reports of the chairmen, which have been regularly published in the proceedings.

That there is important work in abundance for this section to do there can be no doubt; yet from the small attendance at the few regular sessions which have been held, and the number of regrets with reference to the present meeting which have been received from station and college entomologists, the prospect for improvement is not very flattering.

The cause of this apparent lack of interest in the section, or of gratitude to the Association for the opportunity offered entomologists to advance the usefulness of their departments in the colleges and experiment stations, appears not to be the fault of the Association or the officers of the section so much as to causes over which neither have had control. The prime cause is possibly found in the fact that the same class of subjects is discussed at our section meeting as is presented to the Association of Economic Entomologists, which meets at another time and place. Therefore entomologists who can not attend both, prefer to attend that of the Association of Ecomomic Entomologists, where they meet a greater number of entomolog-

ical friends and workers, and at the same time have an opportunity to attend the sectional meetings of the American Association for the Advancement of Science and those of affiliated societies with which the economic entomologists hold joint sessions.

THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

While this Association is the outgrowth of the system of experiment stations, it had its origin through suggestions by Dr. Riley in Insect Life in January, 1889, and a call issued by James Fletcher, Dominion entomologist and then chairman of the entomological club of the American Association for the Advancement of Science. It was organized at Toronto, Canada, on August 29–30, 1889. The objects as definitely stated in the constitution, are as follows:

(1) To discuss new discoveries, to exchange experiences, and to carefully consider the best methods of work.

(2) To give opportunity to individual workers of announcing proposed investigations, so as to bring out suggestions and prevent unnecessary duplication of work.

(3) To suggest when possible certain lines of investigation upon subjects of general interest.

(4) To promote the study and advance the science of entomology.

The constitution also specifies that the members shall be confined to workers in economic entomology.

The active members, up to and including the last meeting, were 88, while the foreign members were 28. Eight regular meetings have been held, at which a total of 171 papers have been presented and published in the proceedings. The value of the meetings to the attending members, and of the published proceedings to all working entomologists, probably exceeds that obtained from any other similar source.

When we consider the plainly specified objects of the Association of Economic Entomologists, its work and results, it would seem that the only special line of subjects left to the entomologists who attend the sessions of this Association of Agricultural Colleges and Experiment Stations is that of methods in teaching technical and economic entomology, and of conducting investigations which have a direct bearing upon the work of the teacher and his students.

It would appear, therefore, that if this Association is to contribute in the future to the material advancement of economic and technical entomology in the colleges and stations, it might be best accomplished through the work of committees appointed to determine and report upon methods of teaching entomology in the various agricultural colleges of the world.

A. D. HOPKINS, *Chairman.*

The report of the committee on indexing agricultural literature, read by A. C. True, of the United States Department of Agriculture, and accepted by the Association, was as follows:

REPORT OF COMMITTEE ON INDEXING AGRICULTURAL LITERATURE.

After careful consideration of various plans, your committee has decided to recommend the following one as being on the whole most feasible:

A PLAN FOR INDEXING AGRICULTURAL LITERATURE.

Scope.—The works indexed should comprise such works in the English language as treat specifically of agricultural subjects or of the direct application of the sciences to agriculture.

Selection of books.—There should be carefully selected, with the assistance of competent experts, a list of, say, one thousand books, of the character above noted. These should be fully catalogued, giving information as to the publisher and cost, and in fact every detail which would make the catalogue useful, with notes where necessary. This catalogue should be published and in sufficient numbers to allow of its being quite widely distributed. The books should be collected and the cataloguing done by the library of the Department of Agriculture, since a large proportion of the books are already on the shelves of the library and the facilities for obtaining information along this line are the best.

Indexing.—The indexing should be done, one division of agriculture at a time, by getting together the books on this subject and carefully going over them in detail. The entries should be made on slips of paper of uniform size and arranged under some carefully-planned system. When the literature of one subject is exhausted, these slips can be edited, and a new subject undertaken. When the whole ground is covered, the slips should be carefully edited and a fair copy made for the printer.

Force necessary.—The preliminary work of selecting the collection and cataloguing it can be done in the Department library without any additional force. The index-

ing work would require one person who is well grounded in practical agriculture and in science and has some knowledge of the literature of the subject ($1,500), and a clerk who is familiar with the use of the typewriter and used to keeping systematic records ($1,000). The indexing should begin at once, as there are in the library the works needed for such a beginning.

Cost.—The cost will include that of the salaries of the two persons, the material, and the printing. It will be impossible to predict the time required until the work is started.

If the plan thus outlined is indorsed by this Association, it is understood that the Department will at once undertake the preparation of the catalogue of books to be indexed, and it is believed that with the support of the Association it will be possible to secure for the Department the comparatively small addition to its funds required to enable it to make an index which will be of very great value to agricultural writers, lecturers, teachers, and students.

Your committee respectfully submits the following resolution and urges its adoption at this convention—

"*Resolved*, That this Association cordially indorses the plan for the preparation of an index of agricultural literature by the United States Department of Agriculture, as set forth in the report of the committee on indexing agricultural literature, and the executive committee is hereby instructed to take such measures as will, in its judgment, best promote the speedy and efficient carrying out of this plan.

"That a committee of five, including the librarian of the Department of Agriculture, be appointed to act as an advisory committee in the selection of the books to be indexed and the working out of other details of the index."

Respectfully submitted.

A. C. True,
W. M. Hays,
H. P. Armsby,
E. Davenport,
W. P. Cutter,
Committee.

In discussing this report, J. H. Canfield, of Ohio, asked for further explanations, since he saw no provision made for the employment of an expert cataloguer to do the work.

Mr. True. This work is to be done, if the plan is carried out, in the library of the Department of Agriculture. There are already there expert cataloguers, who will assist in it. The plan simply proposes to add one person who has some special knowledge of agricultural literature, and a clerk who will aid in carrying out the details. That is, the work will be made part of the work of the library of the Department, and there will be brought to the carrying out of it such assistance as the library is able to give. Of course the persons to be appointed would be appointed under the general rules governing such appointments to the Department of Agriculture, i. e., through the Civil Service Commission. The plan includes not only the cataloguing (which can be done without any aditional force, and which we propose to do at once), but the indexing of the thousand books selected after they are catalogued, making a thorough index of them.

H. E. Armstrong, of London. The subject is one which very deeply interests me at this time. I suppose most persons here are aware that an international conference was held in London last year, attended by two delegates from the United States, for the purpose of taking into consideration the preparation of a complete index to scientific literature by international cooperation. That conference was held on the initiative of the Royal Society of London, and at the present time I have the honor to be chairman of the Royal Society's committee that is carrying on the preparations for this work. I would like very strongly to support, if I may be allowed to do so, the motion that has been brought forward, because what we want at the present time in these matters is experience. Any experiment that can be made is of the utmost value in teaching us how to do the work in the future. The international scheme contemplates commencing the work seriously in the year 1900. Up to that time we want to be trying experiments, so as to ascertain the best methods of working. I think the question put by the previous speaker (J. H. Canfield) and answered by Dr. True, was well put. I think that he has not realized that what we are aiming at is the preparation of complete subject indexes, which are to be prepared as

rapidly as possible, and made available as rapidly as possible. I believe your scheme contemplates literature in the English language only, but of course the international scheme contemplates all languages. We have not contemplated cataloguing agricultural literature, because for the present the index is to be confined rather to pure science; but there is no doubt that if the scheme is successful it must be extended to all branches.

The committee appointed in conformity with the recommendation of this report is as follows: W. M. Hays, of Minnesota; T. F. Hunt, of Ohio; E. Davenport, of Illinois; A. C. True, of Washington, D. C., and W. P. Cutter, librarian of the United States Department of Agriculture.

H. H. Goodell, on behalf of the executive committee, read two paragraphs of the constitution relating to membership, and moved that those persons who had registered and came under the fourth provision of membership be admitted to the floor of the convention during its proceedings.

Carried.

A. C. True read his report as bibliographer of the Association, which, upon motion, was accepted and filed for printing in the proceedings. The report follows:

Report of Bibliographer.

Since the presentation of his last report (U. S. Dept. Agr., Office of Experiment Stations Circ. 31) your bibliographer has endeavored to promote the collection and publication of bibliographical material relating to agricultural science as far as he has had opportunity. The Department of Agriculture is taking increased interest in this matter. Plans are being matured for a general index of the publications of the Department, and some work has been done in this line during the past year by the Division of Publications. The librarian of the Department is cataloguing his library in accordance with the most approved modern methods, is issuing bulletins showing the accessions to the library, and is preparing some bibliographies of special subjects. (A partial bibliography of the sugar beet has recently been issued as Library Bulletin 16.)

Besides the work on the card index of experiment-station literature and notices of station reports and bulletins and the journals of agricultural science prepared for the Experiment Station Record, the Office of Experiment Stations is publishing in the Record an increasing number of book notices. Since the publication of Circular 31 your bibliographer, as director of that office, in cooperation with the librarian of the Department, has continued to note and, as far as practicable, examine works on agriculture and agricultural science as they have issued from the press in the different countries. It has seemed to the librarian and your bibliographer that it might be feasible to publish from time to time notices of books on agricultural subjects by combining the lists given in the library accession bulletins with such statements regarding the character and contents of these books as could be prepared in the library and the Office of Experiment Stations. Something has already been done in this direction, but the work has not yet been put in final form. The largeness of the task constitutes its chief difficulty.

Excluding Government publications and publications of societies, there have been received at the library of the United States Department of Agriculture since the issue of Circular No. 31 of the Office of Experiment Stations, entitled "Some Books on Agriculture and Agricultural Science," something over 700 books and pamphlets relating to agriculture. These are classified as follows:

Botany	160	Seeds	9
Chemistry	77	Diseases of plants	12
Bacteriology	11	Foods	32
Zoology	87	Animal production	22
Meteorology	7	Veterinary science	31
Fertilizers	15	Dairying	23
Soils	4	Entomology	92
Geology	1	Agricultural engineering	2
Field crops	41	Statistics	6
Horticulture	38	Miscellaneous	27
Forestry	20		

A. C. True, *Bibliographer.*

The report of the committee on codification was then read by H. H. Goodell. This report is a compilation of all important resolutions, etc., adopted by the convention

since its organization, topically classified. Upon motion, the report was adopted and ordered to be printed, together with the constitution, in one pamphlet.

A report from the committee on nomenclature was submitted, which, as finally amended and adopted, was as follows:

REPORT OF COMMITTEE ON UNIFORMITY IN STATION NOMENCLATURE.

The standing committee on uniformity in station nomenclature submits the following recommendations to the Association:

BOTANY.

(1) In speaking of the parts of plants, the nomenclature used in Gray's Lessons in Botany should be followed.

(2) No common name should be applied to more than one species of plant. When common name is already in general use for indicating any one of a number of distinct species, as "Milkweed," then the technical name of the particular species under consideration should be given also, as "Milkweed, Asclepias tuberosa."

(3) In the use of common names for trees, the first one given for each species in the "Nomenclature of the Arborescent Flora of the United States" (U. S. Dept. Agr., Division of Forestry Bul. 14) should be given.

(4) In speaking of fungi, the technical, as well as the common name, should always be given at least once in each publication. As the Botanical Club has a list of common names of fungi in preparation, it is recommended that, when published, that list be adopted by this Association.

The committee also submits the following specific recommendations:

(1) *Nodule* (not tubercle).—To be used to designate the enlargements on the roots of leguminous plants.

(2) *Pollination.*—Refers to the application of pollen to the stigma, whether accomplished naturally or artificially.

(3) *Fecundation.*—Refers to the actual union of the reproductive substance of the pollen grain with the egg-nucleus of the ovule.

(4) *Fertilization.*—Refers to the completed pollination and fecundation.

HORTICULTURE.

The committee recommends the adoption of the method of stating the ingredients of the Bordeaux mixture and other fungicides recommended by Beach in the thirteenth report of the New York State Station, page 649, footnote.

The committee further submits the following recommendations regarding the use of three terms which were recommitted at the last convention.

(1) *Sterile.*—Free from living micro-organisms.

(2) *Sterilized.*—Sterilized products are those that have been rendered sterile. Milk heated for a single time to a temperature approximating or slightly exceeding 100° C. is not usually sterile. The application of the term sterilized to such milk is an erroneous use of the word.

(3) *Pasteurized.*—Pasteurized products are those which have been heated to a temperature fatal to the bacteria in a vegetating condition (60 to 70° C.).

H. P. ARMSBY, *Chairman.*

This report in its unamended form contained a recommendation that "in the use of technical names, the law of priority, as prescribed by the Botanical Club of the American Association for the Advancement of Science, should be followed," but on motion of L. C. Corbett, of West Virginia, representing the Section on Horticulture and Botany, this clause was stricken out (see also pp. 46, 71).

Mr. GOODELL. In the report of the executive committee two or three special recommendations were made. One of these has already been acted upon, namely, that with reference to the printing of the report of the committee on codification. The second recommendation had reference to the consecutive paging of the bulletins and annual reports of stations. At the last convention the following resolution was introduced:

Whereas owing to a lack of indexing or to any uniform system of indexing the station publications, much difficulty is encountered on the part of those who wish to consult them, especially where the card index of the Office of Experiment Stations is not available, and to encourage farmers and others in the several States to preserve, bind, and keep them for reference: Therefore, be it

Resolved, That this Association recommends that the publications of each station

for the year be paged consecutively, and that there be appended to the annual report or final publication for the year a title-page and an alphabetical index of subjects similar to that in the Experiment Station Record.

The executive committee, having at that time considered the resolution, referred it back with the report that it was inexpedient to take action. President Atherton thereupon moved that the executive committee be instructed, either directly or indirectly by reference to the proper standing committee, to give the subject as full consideration as possible during the present year, to the end that some convenient system may be adopted. Your committee has already reported upon the subject, and finds that so large a proportion of the stations are already conforming to the recommendation, and find it practicable, that the committee report back the resolution with the recommendation that it be adopted. I move the adoption of the resolution.

Carried.

Mr. GOODELL. There was one other recommendation in the report, namely, that referring to securing necessary legislation for the issuing of uniforms, either as uniforms or as cloth, to the various colleges. The committee recommends the renewal of the action authorized by the conventions of 1893 and 1894, which was that these conventions directed a special committee in one case, and the executive committee in the other, to take the necessary steps toward securing such legislation; and your committee now recommends the renewal of the action recommended at that time.

So ordered.

The report of the Section on Agriculture and Chemistry was read by the chairman, W. H. Jordan, of New York.

REPORT OF THE SECTION ON AGRICULTURE AND CHEMISTRY.

The United States Government, in its paternal capacity, is dealing generously with the art of agriculture, especially in its relations to science and education. In 1897 there will be paid from the National Treasury upward of $2,000,000 for the support of an effort to benefit the industrial classes through instruction and investigation in the several States. Of this sum, $720,000 are appropriated for maintaining scientific investigation—in other words, experiment stations—and $1,100,000 are to be used "in teaching such branches of learning as are related to agriculture and the mechanic arts." A certain proportion of this latter sum is applied to the maintenance of the agricultural departments of instruction in the land-grant colleges, varying in amount somewhat according to the relative pressure which is felt by the governing boards for more money in the several departments eligible to the use of this fund. Besides the Hatch and Morrill funds, so called, the land-grant colleges are receiving annually an income of $600,000 which was made possible by the generosity of the General Government in 1861 and which is also in part used for instruction in the sciences related to agriculture.

It is safe to assert, perhaps, that $1,500,000 are, or should be, applied to the maintenance of whatever our State colleges and experiment stations are doing directly in the interests of agriculture.

This expenditure of money by the people is explicitly authorized for the support of two lines of effort—the instructional effort and the effort of inquiry. We are to teach what we know and to discover what we do not know. What should be classified in the instructional effort and what in the effort of inquiry? Broadly speaking, we may give instruction in matters pertaining to agriculture in three ways—in the class room, through literature, and from the platform. All these are included in our attempt to elevate the constituency and practices of agriculture through mental culture and a spread of existing scientific knowledge. There is but one thing to do in order to discover a new truth, and that is to investigate unsolved problems in a manner that leads to correct conclusions. Much that is called investigation is not worthy of the name; it is simply careful experience not to discover new truth but to illustrate the application of old truths, and is really an instructional effort rather than one of real inquiry, and should be so classified. Such experiences serve their purpose as object lessons merely, being regarded as an efficient way of making an impression upon the agricultural mind.

It is desirable, even essential, to inquire to what relative extent these two lines of effort are absorbing the Government aid which makes them possible. I am free to confess that the conversation, the plans, and the prominent activities of the workers in the agricultural departments of our land-grant colleges have given me the impression, even the conviction, that the instructional effort, as I have defined it, is absorbing a share of the time and energy of the various agricultural faculties and

station staffs which is disproportionate to the funds applied, and that, taking the country as a whole, it has overshadowed the effort at investigation and has really encroached upon the time and means belonging to it.

During the past few weeks I have made an effort to secure such data as would throw light upon the question which I have raised and which would either confirm or disprove my impressions. I took the liberty to present to all the experiment stations a list of questions relating to the ways in which the time and energy of the station staffs are utilized. Satisfactory replies were received from 35 stations that are organized in connection with land-grant colleges. The summarized data thus obtained are very suggestive. It appears that the scientific staffs of these 35 stations include 321 persons. Ninety-eight of these give all their time to station work, of whom 65 belong to the assistant grade, leaving only 33 heads of departments or other experienced workers whose time is not divided between two lines of effort. Two hundred and nineteen persons out of the 321 do more or less teaching, amounting on the basis of actual returns to 50 per cent of their time. Thus while the number of persons on the staffs of these stations is 321, their one-man value for station purposes is only 208, including 65 who are of the assistant grade.

It is somewhat difficult, of course, to reduce to definite terms the work which these 321 persons have performed. We get some indication of it, however, when we find that it one year they delivered, approximately, 2,400 addresses, wrote 208 bulletins—of which 43 did not give the results of research, but were simply intended for instruction—and gave class-room instruction to the value of the full time of 109 men.

The situation becomes fully as clear and striking if we reduce these figures to the terms of a single station. They are as follows:

Average number of persons on staff	9.18
Average number of department heads, etc., who give all their time to station	.94
Average number of assistants who give all their time to station	1.86
Average number of persons who divide their time between the station and teaching	6.26
One man value for station work of those who teach	3.13
Average number of public addresses annually delivered by staff of each station	69.00
Percentage of bulletins intended for instructional purposes	20.00

It seems that 68 of the persons connected with 35 stations are teachers, or, exclusive of the assistants who give all their time to station work, 86.6 per cent give class-room instruction. Moreover, these 9 men find time to deliver each year 65 public addresses and, so far as bulletins are concerned, to put 21 per cent of their writing effort into literature of instruction.

I am convinced that these figures do not fairly express the real facts. According to the returns made to me, the teachers give about 50 per cent of their time to teaching. This proportion is determined, I suppose, partly on the basis of salary payments and partly by the number of hours of instruction. Whatever the basis of judgment, the disadvantage is with the station work. Teaching is a task which must be met at appointed times, enforcing preparation which in science laboratories is extensive and involving that expenditure of nervous energy which good instruction peculiarly demands. Interruptions are at the expense of inquiry work, and if weariness comes, investigation suffers rather than teaching. There are no times and seasons in which a truth must be laid bare. If it can not be accomplished this year, the possibility of doing it constitutes a hope for another year.

So far no enthusiastic searcher for truth with whom I have discussed this matter has failed to deplore the almost impossibility of doing justice to both his teaching and investigations, and the latter suffers because the former will not be put aside.

What can we expect under the conditions but that the investigation shall bear the burden of insufficient time and means? These stations were in many if not most cases projected into land-grant colleges, not as departments with limits and resources that were well defined, but as a variety of duties to be added to those of men already too busy to do their best work. In many instances these new promiscuously distributed departments were not even allowed a distinct head, who should be a well-equipped, inspiring leader in the search for knowledge, and who should place his department on a par with the engineering and literary departments of the colleges; but they were organized under the mere nominal directorship of men who, even if their training would allow, could, because of other absorbing duties, do little else than lend their names for franking purposes. It would be a miracle if work without a head who must make or lose his reputation by its performance, and so parceled out among teachers who must rise to the demands made by ambitious college presidents for the instruction of increasing numbers of students, did not take the last rather than the average chance. I have had some experience with teacher investigators—good men, too—and so far I have seen no instance where teaching duties did

not of necessity take the first place. There is a tendency to forget in making up a schedule of teaching hours, when the teaching force is none too large, that one-half or one-third of a professor's time is mortgaged to other duties. He may be nominally the chemist or botanist of the station, but he is all the time the responsible head of a college department with all its exacting and continuous demands that admit of no delay or leave of absence.

This combination of the teacher and investigator has been supported by the somewhat widespread declaration that a man must be a teacher in order to reach his highest mark as an investigator, a declaration that under the conditions which prevail in our State colleges I regard as an unmitigated, though perhaps comfortable, fallacy. It is, perhaps, true that a specialist may derive benefit from preparing a brief course of lectures relating to his special subjects of investigation, for in this way he is forced to clarify his views concerning disputed points; but to say that the constant grind of teaching three, two, or even one hour a day, generally in elementary work, as do nearly all American college professors, is a help and inspiration to research, I regard as an absurd proposition. Two and two make four in the expenditure of mental energy as in the use of physical force.

I raise the question, therefore, whether the interests of agricultural research in this country are not suffering because nearly all the men best equipped to carry it on are burdened with instructional duties?

There are other facts which indicate, to my mind, that experiment stations are being absorbed in an effort, not of research, but for the utilization of existing knowledge through popular instruction and attention to the business side of farm practice.

In the first place, 65 public addresses have been given by each of 34 stations. Doubtless, the speakers have been the leading men in these stations, those who could make the most favorable impression upon the public mind and the most thoroughly appreciate the public needs. I need not speak of the effect of this outside effort upon one's ability to carry on teaching and investigation work. Besides the constant interruption and the amount of time spent away from the college, there is a serious diminution of the sum total of intellectual energy which may be applied in other directions. Everyone who has engaged in a winter's campaign of popular instruction appreciates the disturbance and weariness which comes from too frequent speaking, late hours, and often irregular eating during forced marches across the country. I regard this work as essential and very valuable, but it is extremely doubtful whether it is not a proper function of the teaching departments of our colleges rather than of the experiment stations. Certainly nothing but the imperative demands for maintaining a successful existence should serve as an excuse for converting an experiment station into a perambulating school. It is very doubtful whether an experiment station should carry the burden of popular instruction work.

The character of station literature is another evidence that we are mainly busy in stirring over the existing mass of knowledge rather than trying to secure more. I do not need to defend here the statement that a generous percentage of the matter of station bulletins and reports consists of a discussion of the relation of known fact to farm practice, matter which has had and is having a profound influence for good upon American agriculture. But is this not instructional in character—popular instruction on paper, if you please—and is the experiment station or is the department of instruction the proper source from which this literature should emanate?

Even the experimental activities of our stations are chiefly an effort to secure the adjustment to farm practice of the fundamental knowledge we already possess rather than an attempt to establish other much needed fundamentals.

In 1896 the Office of Experiment Stations received 32 bulletins treating of cattle foods and cattle feeding. By a liberal interpretation, 3 of these may be regarded as bulletins of research; that is, bulletins in which were represented the results of an attempt to establish new principles or facts fundamental to the use of food by the animal organism. Seventeen bulletins out of the 32 gave the outcome of what may be styled business experiments, experiments which were either practical tests of a theory or an effort to study the use of the local food supply, and the remaining 12 presented no original data, but were a popular discussion of well-established facts bearing upon cattle feeding. Such experiments and such literature are valuable and are instruments of progress, but their existence tends to confirm the conclusion that our main effort is not the effort of research.

Probably I am expected to declare that this trend of American station energy in the past, toward an instructional effort, is to be condemned. If so, you will be disappointed. I recognize the fact that our experiment stations have been organized under such peculiar conditions, and so pressed upon by an outside popular demand for immediately useful material, that at first real research has been difficult. But I think it is fair to raise the question whether we have not reached a point where ignorance of fundamentals is not a greater obstacle to progress than the lack of a popular appreciation of known facts, and whether we should not ask the expectant public to have faith in us and allow us to settle down to hard and continuous study

of difficult problems, which must be solved before we can make material progress in aiding the art of agriculture. Who has not felt when he has faced an audience of well-informed, appreciative farmers that his inability to help them resulted more from his own unavoidable ignorance than from a failure to impress what is regarded as safely known?

Our foreign friends declare that we excel in our methods of putting experiment station results before the public, and of this fact we should be proud. It is greatly to our credit that in this new country, with its large reserve of resources, where the law of necessity is not recognized as in older countries, our rural economy is so beneficially modified by the truths of modern science. I must confess, however, that I am not satisfied to have American workers chiefly useful as a medium for communicating what others discover or to be dependent upon foreign literature for decisive interpretation of Nature's methods. We should not abate one iota our instructional effort either in the class room or by popular methods, but let us not confuse our aims or misuse our funds. Research of the most severe kind is demanded, and the experiment station fund is a research fund. Other means are provided for giving instruction.

It may be profitable for those who are the responsible administrators of the generous Government aid to inquire whether the research effort is fairly treated, whether after all busy teachers are the most efficient instruments for investigation, and whether it is not time for us to more rapidly replenish the fountains of knowledge from which we are so freely drawing to satisfy a hungry public. We may not much longer successfully face this public with a confession that we are ignorant with regard to points of extreme practical importance, and that we are making no severe systematic effort to solve these pressing problems. If our experiment station workers were more independent, and if they were giving more intense and more continuous attention to a less number of problems, our real progress would be more rapid and ultimately the popular verdict would ratify our policy.

W. H. JORDAN, *Chairman.*

Mr. ROBERTS. My experience in this work, both educational and experimental, leads me to the conclusion that what we need more than anything else is to diffuse the knowledge—the accurate knowledge—we already possess, rather than to go on piling up facts which, under the present condition of things, can not be diffused among the industrial classes, for whom we are working. The only question is as to the best means of reaching these men. I am reminded in this connection of the young carpenter who bought $500 worth of fine carpenter's tools when he did not know the use of even the simplest tools he already possessed. The people we desire to reach have got to be taught first principles. The time will possibly come when the intelligence we have now, the facts we have now, will be so widely distributed among the farming community and so intelligently acted upon that the main part of the effort of the experiment stations may be directed toward original research. The problem we have to handle is a very difficult one. We are extremely young as a nation and far younger as experimenters. My experience leads me to the conclusion that the principal object of the experiment stations is to diffuse knowledge of improved methods, and secondarily, to carry on the work of investigation simultaneously.

Mr. THORNE. I have been very much interested in this paper and think the main facts have been very forcibly presented. As an experimenter whose work lies in the station and has no connection with the teaching, I have been constantly surprised that anyone whose energy was directed so largely into educational work could have any time for experimentation, because, as has been stated, that work must take his first energy. But in the latter part of what was said I can hardly be in full sympathy with the speaker, for, as a very lame and halting institute speaker myself, I have found personal contact with the farmers in the farmers' institutes one of the strongest factors in keeping the station in close touch with the farmers, which is necessary in the present stage of station work. As our work is now constituted, we must keep close to the farmer, and everything that keeps us there is so much to strengthen our work. I think, therefore, we should look toward farmers' institute work as one of the great features of experiment-station work to-day—one for which we can afford in some measure to neglect our proper work of investigation. The time will come when we shall be liberated for this work of investigation, but it will

only come if we improve our present opportunity to show the farmer what we are trying to accomplish. We can do this in part through our bulletins, but there are many farmers who can not be reached through the printed page who can be reached with the voice, and to these we must appeal. We are finding in Ohio that the farmers' institute is becoming every day a more and more potent factor in bringing the experiment station in contact with the farmer, and therefore I urge all experimenters to profit by every opportunity to use the farmers' institutes in putting their work and its results before the farmer.

Mr. REDDING. I have been much pleased with what has been said, but especially with the remarks of Messrs. Thorne and Roberts. According to my experience, if we would get the farmers of Georgia, and perhaps of the South generally, to make proper application of what is now generally known and accepted by all intelligent agriculturists in the South, we would at once forge ahead of our sister States. They do not put into actual operation one-tenth part of the knowledge that may be had for the asking. They do not apply even the simpler rules of arithmetic; they do not understand the methods of practical farming; they do not understand the law of per cent, of addition, subtraction, multiplication, and division, in their application to the economic results of farming. They do not need at present to know any more than is already known. Let farmers learn what the farmers' institutes are capable of imparting and make practical application of it to their farming operations. Yet the fact is, they are hungry for a higher degree of knowledge than they are yet prepared for. I have not read over for some months that section of the law which prescribes the duties of the experiment stations, but I rather think some writers and speakers magnify too much the investigation feature and minify too much the practical application of that which is already known. I know it is so in our own State, and I think it is true throughout the South, that the illustrative work done by the stations is very important. It puts the farmer in close touch with us. It does not interfere with the investigative work proper. It may be both investigative and instructive. It strikes me that educational men themselves, those who are devoting their whole time to education in the colleges, do not realize the importance of teaching the things which are not ordinarily learned in books, the practical manual operations of the farm. I have been a farmer all my life, but I find very few farmers know how to do it. I learned it by slow degrees on the farm.

Mr. CLUTE. It seems to me that in the admirable paper which we have had from Director Jordan he very clearly indicated the fact that there needs to be educational work done and also work of investigation. There are none of us, I think, who doubt these two needs. It seems to me he made a valuable point as to what fund shall be devoted to investigation work and what fund shall be applied to instruction work. Now, there is great need of instruction in all our States, South and North, but the Government provided, through the land-grant funds and through the Morrill funds, the means for giving this instruction—through colleges or lectures, or farmers' institutes, or whatever method may be adopted by the States that accept this Government gift. These funds were more specifically for instruction. There is no legal objection to money from the Morrill fund or from agricultural college scrip being given to investigation; but, as a matter of fact, in nearly all States that money is appropriated to instruction. Now, it is evident to all friends of scientific agriculture that but little was being done through these funds for scientific investigation, and therefore there came the Hatch Act, giving money for scientific investigation in agriculture. Now, I submit to the convention whether it is not more in accordance with the spirit of the law that we use experiment station money for experiment and agricultural college money for instruction, as was clearly intended by the law. It seems to me, therefore, that the question asked by Director Jordan was a very pertinent one, for I know that in the South we need not only instruction but the scientific investigation that shall reveal to us the secrets that as yet we are unfamiliar with.

Mr. ELLIS. The good book tells us we are to provoke each other to good works,

and it seems that the paper read has at least provoked some discussion. In the main I assent to most of the propositions in the paper, yet I take it that the almost unanimous applause that greeted the conclusion of the essay was not a manifestation that the members of this intelligent body agree wholly with all the propositions presented therein. We have two sides to this work, the theoretical and the practical, and you live in a fortunate community indeed if you do not find it difficult to get the people to stand shoulder to shoulder with you in your work, for the reason that way down in their hearts they have the idea that you are a set of theorists and can not put anything into practical effect. I am not altogether a policy man. I believe there are certain principles that should prevail in the ordering and organization of our work. I believe also that it is wise for us to look occasionally to the fundamental law under which we are working. It is our chart and compass, and we are able to steer our course aright if we occasionally refer to that source of authority. I do not find in practice that the union of experimenter and instructor is at all detrimental to either phase of the work. I am inclined to think that the man who separates himself from the practical affairs about him, who holds aloof from farmers' institutes and keeps himself in his laboratory, will lose some of the power and force of his investigations and be in danger of becoming a visionary or a theorist. I have had occasion to visit farmers' institutes with some scientific members of our teaching force, and I have sometimes seen these gentlemen run up a stump very effectually by farmers who asked very plain, direct questions to which they desired plain, direct, and unequivocal answers. Now, it seems to me that your theorizer, working in his laboratory, may be able to do some good for the future, but I can not believe he is getting into very close touch with the present. Our farmers are calling on us, as leaders in agriculture, to give them something that is practical. In a bulletin on sheep feeding and cattle feeding which was issued from the Colorado Station we have done incalculable good to the farmers throughout Colorado, who are deeply interested in knowing how to get rid of a large surplus farm product for which there was no market, and the attention that has been directed to sheep feeding and cattle feeding alone in Colorado has done more to popularize the institution in the farming mind than all the other publications that have been issued from the station. Not only have we come in closer contact with the working world, but we have put thousands on thousands of dollars down into the pockets of our farmers, and to-day they are wearing smiling faces because they have a bank account to their credit.

Now, I do not believe we ought to spend all our station energy or all our college energy on this side of our work, but I wish to say in as emphatic language as I can command that unless we do put ourselves on this practical side of our work and show the public that we can do something that will help them in their work we may expect to be regarded as theorists and visionaries. I hope the time will come when we can devote more attention to original research, but I am in hearty sympathy with the gentleman who opened this discussion in the statement that what we need now is to bring to our farmers the knowledge we already have; not only knowledge based upon theory, but supported and strengthened by experience, because we must admit that many of our farming people are ignorant and need the knowledge of fundamental principles and how to apply them directly. I believe also that there is no misappropriation of the Hatch fund in carrying out some of the ideas we have attempted to present to the convention. If you will read the Hatch Act you will find that one of the provisions of the grant is that we may come in close contact with those who are engaged in agriculture and help them in the management of the work upon which they must rely. I believe in the theoretical, but I believe in making the theoretical just as practical as possible, and I do not believe there is any diversion or perversion of the bounty of the General Government in giving farmers' institutes and helping farmers to a practical realization of those problems that come up in their everyday experience.

Mr. Buffum thought the key to the situation lay in popularizing the bulletins. A technical experiment might be reported in such a way that the farmer could get

nothing out of it. The bulletins are for the farmers, and in reporting experiments they should be so popularized that the farmers could understand the work.

Mr. Hays suggested that possibly the way to solve the question was to hold the station funds to their work,and get more money for the popular work. He believed the people would be ready to give more money when the matter was properly presented to them.

The paper was further discussed by Messrs. Curtiss, Snyder, Myers, Mason, and Ellis. The report was then accepted.

A. W. Harris, of Maine, presented a resolution directing the appointment of a committee on a collective exhibit from the experiment stations at the Paris Exposition, which was referred to the executive committee. (See p. 43.)

The convention then adjourned until evening.

Evening Session, Tuesday, July 13, 1897.

The session was called to order by Vice-President M. H. Buckham, of Vermont.

Mr. Goodell read the resolution offered by A. W. Harris on a collective exhibit at the Paris Exposition, with the recommendation from the executive committee that it be adopted. It read:

Resolved, That there be appointed by the chair a committee of five to report to this convention on the advisability of attempting a collective experiment station exhibit at the World's Fair in Paris; and if such an exhibit be thought desirable and practicable, to recommend a plan for its preparation and care.

This was adopted; and the committee (subsequently appointed by the chair) was composed of A. W. Harris, of Maine; H. P. Armsby, of Pennsylvania; W. H. Jordan, of New York; W. M. Liggett, of Minnesota; and M. A. Scovell, of Kentucky. (For report of this committee see p. 43.)

The special committee on revision of the constitution of the Association then reported, as follows:

Report of Committee on Revising the Constitution.

Gentlemen of the Convention: At the tenth annual convention of this Association, held at Washington, D. C., November, 1896, a special committee was appointed "to revise the constitution of the Association and report at the next annual convention." The committee thus appointed, having considered the subject assigned, begs leave to submit the following report:

The members of the committee have discussed this important matter among themselves, and have obtained the opinions of a number of gentlemen heretofore active in the work of the Association whom it has been convenient to consult. A considerable diversity of opinion has been developed as to the most useful form for the Association to take to accomplish its future work, and it seems expedient to present two different propositions.

A majority of the committee and of those whom it has been practicable to confer with favor a radical change in the constitution, and this is first submitted for consideration and action.

This plan proposes the abolition of all sections, so that, if adopted, the annual convention of the Association would thereafter be a meeting of the executive officers of colleges and stations, with such other and special delegates as the institutions respectively saw fit to send to these conferences.

It is believed by those favoring this plan that it will effectively bring the Association back to its original purpose, namely, the consideration in annual conference of the problems of college and station administration as affecting (*a*) internal working, (*b*) relations to the Government of the United States, (*c*) relations to the State governments respectively, (*d*) relations to other institutions, and (*e*) attitude toward new legislation proposed from time to time.

The delegates who are able to assemble annually as representatives of the institutions forming the Association need the entire time at their disposal to enable them to give undivided attention to these subjects of paramount importance.

If the sections are continued, the natural tendency will be to increase the number, because, if it is good policy to have any departments of colleges and stations represented by specialists, it is expedient and right that all departments should have equal opportunities. Following this logical course, it will become more and more difficult than it now is to select and limit the attendance at these conventions.

There are, however, other organizations of chemists, engineers, botanists, etc., which professors and investigators desire to attend, at which they have ample opportunities for the work they now seek to do at the conventions of this Association, and where, for many reasons, it is better for them to go. At these other meetings delegates from the various land-grant colleges and experiment stations come in contact not only with men from institutions of like character, but also with men from all the other colleges and universities and technical schools. This opens a wider field and presents superior advantages. Many believe that, forced on economical grounds to make choice, the institutions concerned and their workers will decide that their time and money can be more profitably used by attendance at these larger and more general gatherings than at the special meetings of this body.

To accomplish the object indicated, the majority of your committee proposes and recommends that the constitution of this Association be amended and revised by striking out certain portions of the existing instrument, as follows:

I. In article on "membership," from section 2, strike out the words "in general sessions" and the whole of the sentence next following.

II. Strike out the whole of the article on "sections," now consisting of two parts.

III. In article on "meetings," strike out section 2 and renumber the sections.

IV. In article on "duties of officers," strike out section 3 and renumber the last section. Also, from section 4, strike out the sentence "It shall designate," etc.

While concurring in the main with the conclusions of the majority, as already set forth, the minority of your committee believes that no other suitable organization exists to bring together for beneficial conference the teachers of agriculture and horticulture, and the sciences as applied thereto, with the station investigators in those lines. Therefore it is proposed, as an alternative to the plan and recommendations of the majority, to so revise the constitution of the Association as to provide for three sections: (1) On college and station work and administration; (2) on agriculture and the sciences applied thereto; (3) on horticulture and the sciences applied thereto.

For the purpose of effecting these changes, the minority proposes and recommends certain amendments to the constitution, as follows:

I. Strike out the first section of the article on "sections," and substitute the following:

(1) The Association shall be organized into sections upon (*a*) administration of colleges and stations; (*b*) agriculture; (*c*) horticulture.

II. Strike out from the second section of the article on "meetings" the last sentence, beginning "The section meetings may be," and substitute the following: "Not more than two sections shall meet or remain in session at the same time, and no section shall meet or remain in session during the general sessions of the convention."

III. In article on "duties of officers," strike out section 3, and renumber the last section. Also, from section 4, strike out the sentence, "It shall designate," etc.

The committee unanimously recommends that no other revision or changes be made in the constitution as it now exists.

And it further recommends that the two propositions for revision above presented be given in full in the call for the next convention of the Association and that time be assigned in the programme for that convention for discussion and action upon these proposed constitutional amendments.

Respectfully submitted.

J. H. Smart,
H. E. Alvord,
H. H. Goodell,
Committee.

The report was accepted.

Mr. True read the following report of progress from the committee on methods of teaching agriculture:

Second Report of the Committee on Methods of Teaching Agriculture.[1]

The committee on methods of teaching agriculture submits a further report of progress. This is based upon the report submitted last year, which was printed in the proceedings of the tenth annual convention of this Association, and in a circular of the Office of Experiment Stations.[2] Before proceeding to consider in detail the topics which should be included in a course of agriculture, and the methods to be pursued in teaching agricultural subjects, the committee has deemed it essential to determine the general relation of a course in technical agriculture to the other courses of study which should be connected with this to form a four-years course in an agricultural college. This task was made simpler by the previous work of the committee on entrance requirements, courses of study, and degrees, whose report, adopted at

[1] See U. S. Dept. Agr., Office of Experiment Stations Circ. 37.

[2] See U. S. Dept. Agr., Office of Experiment Stations Bul. 41, p. 57, and Circ. 32.

the last meeting of this Association, suggests certain requirements for entrance and specifies certain subjects as desirable in all courses given in the colleges in membership with this Association.[1] In the following suggestions regarding a four-years course in agriculture, this committee conforms to that report.

That portion of the report of the committee on entrance requirements, which relates to the subject essential to all courses, is as follows:

"In the judgment of your committee, it is not too much to require the equivalent of fifteen hours per week of recitations and lectures, together with ten hours per week of laboratory work, or practicums, including the time devoted to military science and drill. Upon this basis the above-mentioned general studies should be assigned a relative importance, approximately, as follows:

	Hours.		Hours.
Algebra	75	Modern languages	340
Geometry	40	Psychology	60
Trigonometry	40	Ethics or logic	40
Physics (class-room work)	75	Political economy	60
Physics (laboratory work)	75	General history	80
Chemistry (class-room work)	75	Constitutional law	50
Chemistry (laboratory work)	75		
English	200	Total	1,285

"The total number of hours included in a four-years course, allowing fifteen hours per week for thirty-six weeks, would be 2,140; with ten hours' laboratory work, or practicums, added, 3,600. In general terms, therefore, the foregoing general studies should comprise about two-fifths of the work required for a bachelor's degree."

Your committee on methods of teaching agriculture suggests additional subjects to be included in a four-years course in agriculture leading to the degree of bachelor of science, as follows:

	Hours.
Agriculture	486
Horticulture and forestry	180
Veterinary science, including anatomy	180
Agricultural chemistry, in addition to general requirement	180
Botany (including vegetable physiology and pathology)	180
Zoology (including entomology)	120
Physiology	180
Geology	120
Meteorology	60
Drawing	60
Total	1,746

In reckoning the number of hours, two hours of laboratory work, or practicums, are considered the equivalent of one hour of recitation. In this way the total number of hours in a four-years course is made 2,900, instead of 3,600, as proposed by the committee on entrance requirements.

Your committee also submits the following suggestions regarding the course of study to be included under the head of "Agriculture." In this part of its work the committee has followed the general divisions of agriculture proposed in its previous report. The number of hours to be assigned to each of these general subjects is stated, as well as the main topics to be included under each general subject, and, in some cases, the text-books which may be used in connection with the teaching of particular subjects. These books are, however, named because they are considered by your committee as the best text-books now available on the subjects. They may also serve to show in a general way what would properly be included in the course under the several topics to which they apply. Some notes regarding equipment requisite for teaching the different branches included in this scheme are also given. The number of hours assigned to the different subjects is intended to apply to the average conditions of a four-years course in agriculture. Local conditions will, of course, call for more or less modifications of the scheme here proposed.

Agriculture (486 hours) shall include:

	Hours.
1. Agronomy, or plant production	132
2. Zootechny, or animal industry	162
3. Agrotechny, or agricultural technology	72
4. Rural engineering, or farm mechanics	60
5. Rural economics, or farm management	60
Total	486

[1] See U. S. Dept. Agr., Office of Experiment Stations Bul. 41, p. 52.

SYNOPSIS OF COURSE IN AGRICULTURE.

Agronomy ..... 132 hours.
- Climate, Soils, Tillage, drainage, and irrigation ..... F. H. King—The Soil.
- Fertilizers ..... I. P. Roberts—The Fertility of the Land.
- Plant production, Farm crops ..... G. E. Morrow and T. F. Hunt—Soils and Crops.

Zootechny ..... 162 hours.
- Principles of breeding ..... M. Miles—Stock Breeding.
- Breeds of live stock ..... G. W. Curtis—Horses, Cattle, Sheep, and Swine.
- Stock, feeding, care, and management ..... H. P. Armsby—Manual of Cattle Feeding.

(Animal physiology to be taught under "Physiology;" anatomy and animal diseases under "Veterinary science.")

Agrotechny ..... 72 hours.
- Butter making ..... H. H. Wing—Milk and its Products. H. B. Gurler—American Dairying.
- Cheese making ..... J. W. Decker—Cheddar Cheese Making.

(Other topics, such as sugar making, wine or olive oil making, may be taught under this head in different parts of the United States.)

Rural engineering ..... 60 hours.
Roads, drains, irrigation systems, farm buildings, and machinery.

Rural economics ..... 60 hours.
History of agriculture.
Farm management, rural law, farm accounts.

EQUIPMENT FOR COURSE IN AGRICULTURE.

The following brief statements may serve to show in a general way the equipment required in connection with the instruction given in a four-years course in agriculture:

Agronomy.
- Field trials of various crops for class demonstration.
- Laboratory (including glass house) for work in soil physics, pot experiments, etc. This laboratory should have a floor space of from 1,000 to 2,000 square feet.
- Collection of soils, fertilizers, plants, etc., for class illustration.
- Photographs, lantern slides, charts, diagrams.
- Books of reference.

Zootechny.
- Live stock of different types and breeds.
- Lecture room, arranged for exhibiting live animals to class and equipped with instruments of precision for weighing and measuring.
- Collections—models, mounted specimens of animals, specimens of foods, etc.
- Lantern slides, photographs, charts, etc.
- Reference books, especially herd books and stock registers. (There should be a seminary room for the use of these books.)

Agrotechny.
- Dairy laboratory (this should include the following rooms, which may cover some 6,000 feet of floor space): Butter-making room, cheese-making room, cheese-curing room, pasteurizing room, receiving room, storeroom, refrigerating room, boiler and engine room. These rooms should be equipped with all modern apparatus for testing and pasteurizing milk and making butter and cheese.

Rural engineering.
- College farm should illustrate various problems in farm engineering, such as roads, drainage, and irrigation.
- Laboratory, equipped with apparatus for illustrating various mechanical problems in farm machinery.
- Collections—tools and farm machinery.
- Lantern slides, charts, and diagrams.
- Reference books.

Rural economics.
- Reference books.

It has not been possible for the committee to extend its work beyond the formulation of the outline plan given above. It is hoped, however, that the tentative

scheme thus broadly sketched may serve a useful purpose as a basis of the details. It is felt that much will be gained if the officers and teachers of agricultural colleges come to realize that the success of courses in agriculture depends very largely upon a wise planning of the subjects to be included and the securing of adequate equipment to supplement the personal service of the teacher. There can be little doubt that under present conditions the success of teachers of agriculture is often greatly impaired and much valuable time of both teachers and students lost because of lack of adequate equipment. Without suitable laboratory facilities and an adequate supply of illustrative material it is practically impossible for a teacher to do his best work or for the student to gain a thorough mastery of many of the subjects included in courses in agriculture.

In continuing work on the important problems submitted for its consideration, your committee proposes to take up in detail during the next year the topics included under the general head of "Agronomy," with a view to presenting a syllabus of a course in that subject which shall show with some fullness the topics to be treated, their relative importance, the time which should be devoted to each, and especially the order of presentation which conforms most closely to sound pedagogical principles. In this work your committee solicits the active cooperation of the members of the Association, and will most heartily welcome suggestions which will promote the success of this undertaking.

J. H. Connell,
A. C. True,
T. F. Hunt,
H. T. French,
H. H. Wing,
Committee.

Upon motion, the report was received and the committee continued and instructed to carry on their work as a committee.

Mr. Harris. I would like to ask if the words "zootechny" and "agrotechny" are new words. Have they been invented by the committee or are they words in good standing?

Mr. True. "Zootechny" is a word commonly used in Europe, and includes what is commonly taught as animal industry. "Agrotechny," as far as I am aware, is a new term, and was used by the committee to avoid the use of two words, i. e., agricultural technology. We thought it would be simpler if some such word as "agrotechny" came into use to cover this subject.

Mr. Washburn reminded the convention of the invitation given by President Hill, of the Great Northern Railway, to visit on a special train the Red River Valley. The invitation was accepted, and the following resolution of thanks, offered by H. C. White, of Georgia, adopted by a rising vote:

Resolved, That this convention accepts the cordial invitation courteously extended by President Hill, of the Great Northern Railway Company, to visit, by special excursion, the great Red River Valley, and in so doing begs to extend to President Hill and the officers of the Great Northern Railway the assurance of its sincere appreciation of the munificent hospitality thus extended them and its grateful acknowledgment of the kindness which has prompted the offer of an opportunity to inspect under the most favorable auspices an agricultural region of great and peculiar interest.

The annual address of the president was then delivered by Mr. Fairchild.

Evolution of Agricultural Education.

The great problems of genuine education are never solved, but ever solving. Each generation extends the range of matter and of method; yet still the great problem recurs, How shall the next generation be trained? The shades of thought upon this theme are endless in variety. Last week a huge volume was made at Milwaukee, adding one more to the series already superseded. And so my little venture of to day may engage but passing attention, while the world moves on through richer experience into forgetfulness of the meandering ways of the past.

Agricultural education has represented some distinct thought for just about an ordinary lifetime. Some now present can recall the earliest efforts to bring labor and learning into partnership on the farm; a few, at least, can tell of the derision with which the clodhopper's college was welcomed. The jubilee of the Royal Agricultural College of England was celebrated only two years ago, though its halls

have never been open to other than gentlemen's sons. In our country forty years cover the life of the Michigan Agricultural College, the oldest of our circle. This lifetime of development it has been my good fortune to touch all along the line, and you will pardon occasional reminiscences in attempting to enforce upon attention again the original problem of bringing the up-to-date enlightenment of truth into the everyday life of the farm home; for with all the progress made, we are still asking how shall agriculture and education thrive together in such a way as to lift this mass of humanity to a plane where the supremacy of mind shall be permanent and pervasive. So far as I can see, the problem is not less real than when I first heard it broached, full fifty years ago, in an address at a fair in a little country village in Ohio. Yet how marvelously changed is its form! I shall try to set forth the principal stages in this evolution under the phrases, education *for* agriculture, education *in* agriculture, and education *by* agriculture, hoping to make clear the evolution as I proceed.

In the earliest attempts to combine learning with labor the thought of philanthropists was almost wholly absorbed in devising ways to give a liberal education, then a well-understood training in Greek and Latin, with mathematics and a modicum of science thrown in, to the youth whose natural place of energy was on the farm. At least the movement contemplated the discipline of the established course with barely suggestions of applications in everyday problems. To enliven the life of the farmer with interest in literature and scientific principles, and so to encourage his own ingenuity and energy of thought, seemed object enough. With such a view a course of winter lectures for farmers was organized about fifty years ago in Cleveland, Ohio, under leadership of the lamented Dr. Norton S. Townsend, later professor of agriculture in the Ohio State University. Some of the best educators in the region were associated in the work. An older brother of mine, then and since connected with Oberlin College, carried the literary part of the work, with the earnest hope of opening to farmers of the Western Reserve the treasures of pleasure and of power in the world's best thoughts. This lecture course failed for lack of patronage as well as lack of endowment, just as other good enterprises have failed. But the idea was taking, and in 1862–63, at the opening of the land-grant colleges and schools in universities, much the same ideas led. The oratory of those hopeful days is filled with enthusiasm over the wedding of labor and learning. The curricula proposed differed little from the standard of other schools, except that an agricultural bias was to be sought by selecting from classic stores the Greek of Hesiod's Work and Days and the Latin of Virgil's Eclogues. Good English pastoral poetry could relieve the tedium of Tusser's Five Hundred Points of Good Husbandry. It was years before agriculture itself found more than incidental—I might almost say accidental—recognition in a few applications of chemistry in soils and manures, of botany in scientific names for the cereals, grasses, and garden truck, and of mathematics in land surveying. When at last the professor of agriculture was found, he suffered the stigma of being an exponent of books, and was dubbed, to avoid it, professor of practical agriculture or practical horticulture.

The professor's instruction necessarily became a body of information—historical, accounting for habits and practices; demonstrative, illustrating the best practice from cullings of reports, addresses and descriptions of travel—in fact, it was a great deal about agriculture with little of it. The elevation of mind in the man was still to be cared for by a solid training outside of the art to be taught. Those of us who did the work in those early days know how constantly and incessantly the contrast between discipline and information appeared.

Moreover, the very body of information was matter of dispute. The professor was charged with incompetency. His crops were said to be inferior; his specimens of stock for illustrative purposes were said to be not types; his instructions were not applicable to the pioneer farming to which his pupils were accustomed; his methods were extravagant; in short, his farming was an exponent of theory rather than the practice of the thrifty farmers who criticised him. Perhaps it was originally only a student's joke; but to this day within the shadow of college walls you hear the echo from the tale of turnip seed sown by the peck instead of the pint, of corned sucking calves, or of cows ruined for lack of milking. The antidote for these symptoms of dissatisfaction was usually the installation of the farmer himself as instructor. It was the boast of such an instructor, afterwards a member of the legislature, that when he was at the college they had "both the practical and the theatrical." Under this régime, labor in the field became the chief element of instruction, while lectures dwindled into readings from standard compilations on farm economy. Bright students and witty ones made fun of the lectures and berated the field tasks, to the torture of faculties and boards of control. Long courses and short courses were equally unsatisfactory, as combining little learning and less labor to the advantage of neither.

But the leaven was working, nevertheless. Men of science began to find illustrations of chemical reactions in the processes of vegetation and growth as well as in

farm methods. The chemistry of feeding and the physiology of breeding began to have interest as studies of both nature and practice. The introduction of farm machinery enlarged the application of mechanics. Comparative anatomy and physiology aroused new interest in domestic animals and their development. The studies of Darwin made the story of both plants and animals under domestication especially interesting. Methods of teaching the sciences took on more of laboratory character, to their great advancement as disciplinary studies. The development of horticulture into a specialty for large portions of our country, the adoption of intensive farming with the growth of better markets, the enormous extension of the cattle interest with the opening of great packing houses, and withal the general thrift of the whole community aroused a new interest in education for the industries of all kinds.

So the agricultural schools became centers of a new enthusiasm. The facilities of farm, shops, gardens, greenhouses, orchards, and vineyards were immensely increased. The college campus began to illustrate the taste and culture of the place in landscape gardening. Instead of the model farm, so much talked of in the early days of the undertaking, we gain the ideal of a museum of agricultural processes, where farmers and farmers' sons may have illustrated the general phases of agriculture furnished throughout the world. Criticism of the crop was now changed into criticism of the ingenuity of the professors in devising new methods or their diligence in trying new varieties. Students looked for the novelties in agriculture, and rivaled the professors in enthusiasm for research for the new and the untried. The ideal had changed from training for agriculture into training for experiment. The quickest and clearest minds among the students were the chosen assistants in this extension of the ideal. The budget of wants presented to legislatures included large items for experiment. Where once hundreds were refused for the ordinary necessities of shelter for stock, now thousands were granted for experimental stock barns, piggeries, and propagating houses. Genuine experiment stations were heard of and asked for. Plans for enlisting Government aid were broached at conventions and institutes. Occasional bulletins and reports of experiment and research began to attract attention to these colleges as centers of expert knowledge. Farmers' institutes demanded expert lecturers on all sorts of topics in agriculture. Courses of lectures for farmers were again undertaken, with special reference to revised information in agricultural practice.

To meet this changed demand, the colleges necessarily changed ideals and methods. Experiment and expert training are necessarily associated. University courses in agriculture were sought and found. The general courses became more or less elective, with a view to hastening expert training. With the opening of the national stations in 1878 a large demand for experts in agriculture arose, and all available timber was put into the framework of college and station. Specialists in every line of investigation have been called for and produced, sometimes on short notice, but with earnest desire to furnish genuine training and information in agriculture and related sciences. The few colleges already past the stage of mere information for agriculture and reasonably well equipped for research became the sources of immediate supply for station workers and professors, so that education *in* agriculture was at once brought into prominence.

The additional equipment and support provided under the act of 1890, with direct emphasis upon agriculture and the mechanic arts, gave more than the means for enlargement. It supplied the directive energy heretofore lacking. Now, whatever may be lacking in the methods of the schools, there is no dispute over the fundamental question whether agriculture shall be taught. It must be taught, and related sciences must be related, and relations must be emphasized. Long courses and short courses in agriculture are everywhere advertised. Chemists, botanists, entomologists, anatomists, biologists, and physicists are glad to find a place in the evolution of agricultural science, and reckon among their highest testimonials evidence of practical adaptation of knowledge to the industries of the soil. Even the experts of the dairy and of the stall are beginning to seek the advantage of the schools, and courses are planned to meet them half way. The evolution of agricultural education to the stage of education in agriculture is fairly recognized by the establishment of machinery for expert training in truly agricultural science in nearly every State of the Union. The extent of equipment and experience varies almost indefinitely, but the ideal is present and the methods and illustrations are at hand for imitation. University training in agricultural science has come to stay.

What an advance in fifty years! The pioneer colleges found little of distinctive knowledge in agriculture, and chairs of agriculture were derided from the one side as impractical and from the other as empirical. To-day the chief universities of the land claim prestige for their application of knowledge to the field, the forest, the garden, and the stall, while the people are complaining that their doctors of science can answer only a few of the pressing questions from their hurried business needs. Young men see visions of renown in special studies and spend years of time and thousands of dollars to fit themselves for observation in these fields. With the

whole world asking questions which only experts can answer, there is reason to expect their sure reward. This Association is doing well to foster both the questioning and the answering, and is itself a monument to the growth of all these years. I recognize my own reward for a third of a century's work upon this field in being allowed to preside over so notable a body of associates.

So far the ever-recurring question, what shall be taught in our agricultural colleges has answered itself. So much must be taught, in order to meet the demands of our times, that we give more time to discussing what can not be crowded into our courses than to deciding what *must* be included. Every professor is asking more time, better laboratories, larger libraries, and more expert assistants and associates. The industrial end of the universities is first in demand, and will soon be first in accomplishment. The most noted professionals will soon be our doctors of applied sciences. The experts have come to stay, and the courses of study that make them will not only stay, but grow.

Still the original problem remains, "How shall men of toil find elevation by their toil as well as in it?" How shall farmers learn to think as well as to follow the lead of thinkers in matters of practice? How shall this body of science come into touch with the body of toilers? Has liberal education come to the masses?

We are still trying to solve the problem. Farmers' institutes and lecture courses are endowed by State aid to do the same work on a larger scale attempted fifty years ago by Dr. Townsend and his coadjutors. This, too, is a grand advance, that farmers will tax themselves to maintain such courses. But what one of you who works in such institutes feels satisfied in results? Who does not find such lack of elementary principles as to discourage his efforts in leading to higher and clearer thinking? Who does not fear the power of the fraud in science over the very people he has tried to lift to a scientific plane? If the people have learned a portion of our scientific nomenclature, is it not just enough to make them accept anything which bears these names?

Can we remove this ignorance with books? Shall the Bureau of Education and the Department of Agriculture supply elementary information in tracts innumerable to be added to the infinite waste of public documents taken usually at its own estimate of "no cost, no worth?" Is it possible that good books, embodying the essential definitions of agricultural science, may be distributed through reading circles and public libraries and book agents even, to arouse to genuine thinking and true observation?

I confess myself doubtful of results in all these directions. Tracts are chiefly useful in urging people to do what they already know how to do. Definitions mean almost nothing, even to students, till the substance of matter defined is already touched by the mind through the senses. Nomenclature merely hides knowledge from the uninitiated, and definitions are but names without the constant touch of things upon which the names are realized. I have yet to find an elementary exposition of agricultural science which is not more obscure than the larger treatises from which it is compiled. An epitome of any science is clear to the scientist alone. The rest of us must take his assertions on faith, as mere symbols of knowledge. Of the Chautauqua Circle of Science I have greater hope, because of the measurable success of similar efforts in history and literature. But here I find the difficulty that leaders in such circles are themselves deficient, and the public mind is less leadable in this direction than in others. The reason is obvious. Every community has earnest men and women trained in appreciation of literature and awake to the grand facts of human history. Every community is made up of people whose everyday life interprets history, and whose common-school training, Sunday exhortations, public orations, and newspaper flourishes are filled with allusions to history and literature. The very grammars glow with the rythm of our poets and the eloquence of orators. Reading means to most of us either the force of ideas or the rythm of expression. But for science we have no such foundation of constant and long-continued acquaintance. People are likely to take words instead of things, the most fundamental source of lasting ignorance. The very familiarity as to things, with but few ideas about them, detracts from interest in their analysis. Scientific thinking is more analytic than common modes of thought. Even the trained thinker in the older channels of education finds his habits of synthesis too strong to wait for detailed examination of individual characteristics. He has to sit at the feet of an Agassiz in patient unfolding of parts, casting aside as worthless his ready-made generalizations from surface observations. How much less can one whose limited training, all in the same channel, has given place to doing according to crude analogies, pick up in middle life the scientific methods and scientific trend of thought. It is little wonder that the Audubon clubs, as Alfred Wallace remarked, are formed to shoot pigeons. The enthusiastic patron of birds has become the patron saint of their destroyers.

If, then, neither the schools of agriculture, the institutes, the elementary texts, nor the reading circles furnish the full solution for our problem, whither shall we look? Must we give up the task and be satisfied to have an aristocracy of learning

who shall rejoice together over the grand enlightenment of our little circle, while the "hewers of wood and the drawers of water" render stalwart service under our exalted direction? There are highly educated men and trained scientists who accept this condition as final and rejoice in such a reign of caste. But you and I stand as exponents of scientific, liberal education for the industrial classes. Following the lead of the illustrious Senator whose name these institutions will ever commemorate, we can not for a moment admit that our education offers only indirect benefits to the masses. We must solve the problem of combining learning and labor without confining the learning to the top stratum. A real civilization requires it, and requires it of us. I think we are ready for the third stage of our evolution in education *by* agriculture.

Between 40 and 50 per cent of our people live by agriculture directly. More than that proportion of children are in our rural schools, gaining all their introduction to the manner and matter of the world's thought from elementary training in reading, calculating, and memorizing general statements about the earth and its history. Between these schools and the specialist in agricultural science there is a great gulf fixed—not impassable, perhaps, but so nearly so that neither seems interested in the other. I would bridge that gulf at first, and by and by fill it by making agricultural facts, principles, and practices a basis of education for those very people whose interests grow out of agriculture into touch with all the world. I am not so enthusiastic as to believe that this can be done by simple direction. It must be as truly an evolution as all the rest has been. But it will grow from intelligent efforts led by the same earnest philanthropy that founded these colleges. It must grow from the top down, as such growth has always been. Will you bear with me while I urge my pet scheme, even though it be as yet in the sap? It would not grow if it were not sappy. But I hope it may have sapience as well as sap.

The starting point must be in our general courses for agricultural schools. Many of you have felt the need already of welding more completely the training of the course with the lectures in agriculture and horticulture. Some have succeeded in making an outline of studies in agriculture, at the same time a series of problems to be solved by the use of knowledge gained in other sciences. A few scientific teachers have developed direct interest in their special sciences along the lines of familiar objects in agriculture. With united effort the range of such interest can be greatly extended till the bulk of information open to the student of agriculture can be connected with its appropriate sciences, both as illustration and application. Under these conditions a greater bulk of matter of this kind can be used in the course, for it will be just as truly disciplinary, educative, as any other matter. The old contention against scientific courses, as lacking the best element of training to think, was proper so long as the sciences were chiefly descriptive. But since every science has grown into a philosophy with ever-varying problems of relation and signification nobody doubts the educational value of such study. Students grow into accuracy of analysis, accuracy of generalization, exactness of expression, under good teachers, as well by the sciences as by any other study. There is reason to expect the same evolution of methods in agricultural and horticultural teaching. When it comes, such studies will reach further in the course and supplant some essentials of any liberal training. The problems of mathematics can easily serve in every agricultural inquiry, and the quests of agricultural science furnish problems for mathematics and drawing. This will require the mutual ingenuity of teachers in both lines, but our colleges ought to furnish the enthusiastic combination. With such a union of forces there ought to be a natural growth of data for constant work along the lines of local investigation and comparison toward the development of interest in general courses outside the strictly agricultural schools. Knowledge of common things by means of common things gives a true foundation for all knowledge, as the world is coming to believe; and we should take advantage of this trend of educational thought to introduce our common senses to this world of nature in farm and home. The day when colleges were monasteries is past, and the curriculum of the past, good in its day, is fast following. Grant that it has made the thinkers of the world, still it can not again do the same work for the world. We must welcome the growth that opens every channel of thought to the learner by making the problems of nature touch him at every turn. Even the older institutions are ready for suggestions, while the younger instructors are rivaling each other in devices to popularize learning. Nothing can give greater or truer note to any man than making scientific truth tributary to the common life of the race by forcing it to enter their daily thinking.

Later, when colleges and normal schools are well imbued with ideas touching home life, it will be possible to find instructors and make courses for county teachers' institutes that train for nature teaching. Then text-books and teachers will follow the lead of the thinkers into adjustment of interests with methods of gaining the elements of knowledge. So far as my knowledge goes, such efforts in the past have failed. Teachers of our State have been asked for years to fit themselves for a State examination in botany, entomology, and zoology. Few have gained any such

knowledge for the reason that no immediate use was expected, and no devices for use have been suggested. The same fact may be stated as to drawing, so long as students are not expected to think or to express their everyday thoughts in lines. Yet the everyday use of drawing is quite as evident as that of writing as soon as one realizes how easily the sense of sight can find expression and clearness of meaning in lines.

With the body of teachers secured through agricultural colleges and well-developed normal schools, I would have ready for their use a collection of text-books framed for the work of developing ingenuity of thinking in children, with all the material close at hand. Already the masterpieces of literature concern the elements of knowledge in rural life. I would adjust to every stage of unfolding the life story of plants and animals; the varied phases of soil and sunshine and shower; the power of man in making or marring the glory of the years in landscape; the evolution of utilities in fruits, grains, forage, and textile plants. Then the whole interest of tales from travelers may be utilized for comparison, and so the highest humanities be linked to life as it is through the reading lessons. Reading itself becomes most natural and earnest by calling upon the thought of the child for a meaning.

Geography, too, is finding its way to the thoughts rather than the memory of children. I would have it more thoroughly an exponent of each child's relation to the earth and its contents, so that he should recognize himself as the center of a universe, to be possessed by his own efforts of locomotion, of examination, of communication, of exchange, of cooperation. For the least ones, the confines of the home yard furnish geography enough, in which relations of soil, seed, sunshine, and shower to vegetation in all the varieties of relation may be studied with senses as well as by words. Even the relations of animal life to vegetation may be appreciated by the children just learning to read, and simplest facts observed for daily recitation will count indefinitely more toward genuine understanding than whole pages of memorized wonders.

The more complete geography can well follow the methods of mere home study. Each new territory will find its basis of knowledge in the facts fixed by observation. Each new combination of seasons will find its description and its reason in the relations already sensed at home. Out of these comparisons will grow a similar comparison of possibilities in products, and so commerce is no isolated fact, but as natural a relation as the exchanges of the neighborhood.

With such a natural geography, history becomes absolutely essential. It can not be a dreaded conglomeration of names and dates, but must be the story of processes similar to those of daily life. The world's agriculture has had quite as much to do with the building of nations as any other factor. The history of the future will dwell on this fact, and show how the food product of the various countries has given character to manufactures, to commerce, and even to education and the arts.

Even arithmetic and algebra will furnish a range for agricultural ideas. Rural arithmetic really differs from city arithmetic in the range of its applications and the ingenuity needed in applying its principles. A large variety of problems in measurements, weights, content, of cribs and of mows, are ready at hand. A multitude can be devised in the necessities of ordinary country and village commerce, and still more in the profit and loss of cropping, feeding, and transportation of produce. Much of the economy of the household can be used in the same way, with gain to the arithmetic from interest in the results, while the habit of accurate thinking on everyday topics is established early.

If the geography has been rightly used as a description of the earth and its contents, the way is opened by curiosity for all the sciences. Physics and chemistry will be studied even without a teacher: but with the quickening help of a live teacher the everyday facts of the farm will be basis enough for bringing out questions and answers that open the way to extensive study. Zoology is well begun in watching the life and investigating the anatomy of bird, beast, fish, and insect at home. The schoolhouse ought to afford room for all the curiosities of home fauna, and the teacher needs time and knowledge enough to be interested in all. Its bare walls might soon be made to shine with interest for every child with a very little means under the contrivance of live teachers interested in the thinking of rural life.

Of course botany opens an easy admittance to some of the secrets of nature on the farm. The teacher whose lens can arouse the curiosity of children in the minute structure of plants will find their interest in the laws of growth and its endless variety indefinitely extended. By skillful use of books, pictures, and the material children bring, the thoughts of even the little ones may become their best educators. These observations, too, can be made directly profitable. Every teacher of sufficient enthusiam can become a missionary for disseminating the truths and devices of our station experts. The noxious weeds, the mildews, rusts, and scabs are matters of interest to the whole family, and the way is made clear for seeking a wider and more satisfactory knowledge.

Moreover, such teaching of science as knowledge of everyday things settles the

vexed questions of language lessons and training in expression. Help the child to have something to tell, and he wants to tell it in the best way. But the best result of such telling is the habit formed for the work of after life. I have in mind a youth whose awakening to scientific search for knowledge was caught before he left the common school by a brief course in botany. His desire to describe correctly had given him the true logic of composition before he touched a rhetoric. I remember with what energy he caught the principles of exact expression in his freshman year as a means to his end. It was easy to predict for him not only the insight of an accurate observer but the graces of a ready writer. To-day his name is among the chief of benefactors to the people in their homes, through a literature that they can comprehend. You all know him as Liberty H. Bailey.

I have dwelt too long, I fear, upon details which are only speculative; but I can not believe that the world is going to be satisfied with any introduction of learning to the farm which leaves the farmer unable to do his own thinking along the lines opened by our experts. If my ideals are at all practicable, the youth of rural neighborhoods can some time have clubs that mean a genuine study, reading circles that shall rival Chautauquan energy, and farmers' institutes that call for your highest energies.

Now is the time to work through voice and press upon the ear of the people. The teachers are already inquiring for a more thoughtful course of study. The leaders are asking if nature studies and culture studies may not be combined. Some States are attempting genuine reforms in the advancement of rural schools. Why should we not join forces with this reform and give it a definite aim by asking for a genuine education for agriculture, in agriculture, *by means of agriculture itself*. The chief initiative is with the teachers of agriculture and horticulture in the colleges of this Association, who must find the way to make their teaching most enlarging to the learners. The rest of us, associates of these leaders, must not be slack to fall into line by adjusting our subjects in outline and illustration to the natural thinking of our pupils. The world will take the hint. Books will grow to our needs. Above all, teachers of common schools from among the educated farmers sent out by us will prove their power to lead the youth of the farms into thoughtful interest in their relations to all the rest of the world.

Would that I might live to see such an actual wedding of labor and learning in the farm homes of our land through the evolution now in progress. The perpetuation of the world's welfare requires it.

Upon motion of J. E. Stubbs, the following resolution was adopted:

Resolved, That we, the members of this Association, have listened with deep satisfaction to the address by President George T. Fairchild on "The evolution of agricultural education," and that we desire herewith to express to him our high personal esteem and also to honor his long, distinguished, and inspiring service to the cause of education, especially in the field of agriculture.

A communication from the Section on Mechanic Arts upon the question of Federal endowment for engineering experiment stations was read and referred to the executive committee. (See below.)

A. Cope, of Ohio, offered a resolution directing the appointment of a committee to devise a plan whereby graduate students of land-grant and other colleges may have access to the use of the Congressional Library and the collections in the scientific bureaus at Washington, etc. Referred to the executive committee. (See p. 39.)

Morning Session, Wednesday, July 14, 1897.

Called to order at 9.20 a. m. by President Fairchild.

Mr. Goodell, on behalf of the executive committee, reported back, with recommendation that it be adopted, the following resolution:

The publications of the General Government and its several departments being of especial value in the work of the land-grant colleges and stations, it is hereby moved,

That the executive committee of this Association be asked to take such steps as by legislation or otherwise will create each of the land-grant colleges a depository of all Government publications, including all past publications as far as possible.

Adopted.

The following report from the Section on Mechanic Arts was reported back by the executive committee with recommendation that it pass:

At a meeting of the Section on Mechanic Arts of the Association of American Agricultural Colleges and Experiment Stations, held on July 13, 1897, President C. S.

Murkland, of New Hampshire, in the chair, it was moved by President Canfield, of Ohio, seconded and passed, that a committee of this section be appointed to report to the Association in general convention the feeling of this section respecting any needed Federal endowment for the establishment of engineering experiment stations.

The committee appointed respectfully submit the following:

(1) That the necessity of more extended Federal aid for the existing similarly endowed institutions is fully recognized and urged upon the attention of this convention.

(2) That such new endowment should be, "To establish engineering experiment stations in connection with the colleges established in the several States, under the provisions of an act approved July 2, 1862, and acts supplementary thereto."

(3) That these stations should bear the same relation to the instruction given in these institutions in engineering and the mechanic arts as that now borne by the agricultural experiment stations to the agricultural interests.

(4) That such a proposed measure should be brought before this convention and fully considered by it.

(5) This committee recommend that a special committee of five be appointed to formulate the necessary provisions of such a measure to be submitted to this convention.

W. S. Aldrich,
O. Clute,
C. W. Hall,
Committee.

The report was accepted and the special committee of five referred to in the fifth section was appointed by the chair, as follows: C. S. Murkland, of New Hampshire; W. S. Aldrich, of West Virginia; C. W. Hall, of Minnesota; A. W. Harris, of Maine, and J. E. Stubbs, of Nevada. (See p. 52.)

The executive committee also referred back, with recommendation that it be adopted, the following resolution, offered by A. Cope, of Ohio:

Resolved, That a committee of five be appointed by the president to investigate, consider, and, if practicable, devise a plan whereby graduate students of the land-grant and other colleges may have access to and the use of the Congressional Library and the collections in the Smithsonian Institution, the National Museum, and the scientific bureaus of the various departments, at Washington, of the United States Government, for the purposes of study and research; said plan to include suggestions as to the manner in which such work may be organized, coordinated, and directed, to the best advantage; the composition and organization of such a staff as may be necessary to properly coordinate and direct such work, and also an outline of such legislation as may be necessary to effect the general purposes of this resolution.

Said committee to report at the next meeting of the Association.

This was adopted, and the chair appointed a committee consisting of A. Cope, of Ohio; M. H. Buckham, of Vermont; C. Northrop, of Minnesota; A. Ellis, of Colorado, and G. E. MacLean, of Nebraska. To this committee was afterwards added J. H. Washburn, of Rhode Island. (See p. 54.)

M. A. Scovell, of Kentucky, presented a memorial asking the Secretary of Agriculture to accept, keep on file, and if possible compile, the records of the committee appointed in 1893 to assist in conducting dairy experiments at the World's Fair. These records, he explained, were still in possession of the chairman of that committee, and though efforts had been made to get them printed, the cost (estimated by the Public Printer to be $70,000) stood in the way. Nothing is said in the memorial to the Secretary of Agriculture about printing; it is simply desired to have the records kept on file and available. He asked the Association to indorse the memorial and refer it to the executive committee.

So ordered.

The memorial is as follows:

Hon. James Wilson,
Secretary of Agriculture, Washington, D. C.

Dear Sir: The undersigned members of the committee on dairy tests, appointed by the World's Columbian Exposition in 1893, beg leave to submit for your consideration the following statements regarding the tests of dairy cows made under their supervision at the World's Columbian Exposition, together with a proposition looking toward rendering the results of these tests available for the use of students and investigators in dairying.

The tests of breeds of dairy cattle here referred to were conducted by the World's Columbian Exposition at Jackson Park in 1893, upon a scale and with a thoroughness never before approached. These tests were unique in many particulars. and furnished an opportunity for the study of dairy problems such as could only have been secured under the auspices of such an organization, and such as may never occur again.

Four tests were conducted—one of fifteen days for cheese; one of ninety days for butter, and all by-products; one of thirty days for butter only; and one of fifteen days for young herds. In the first two tests, three breeds of cattle with 25 cows each, competed, viz: Jerseys, Guernseys,and Shorthorns.

The cows of each breed were selected by the respective breeders' associations after prolonged search as the best available representatives of their several breeds, and were fed and handled by experts.

Nearly 3,000,000 separate entries of facts were made during the tests. The figures include daily analyses of the milk of each cow and herd, detailed daily statements showing kind, quantity, and cost of food consumed by each cow, weight of milk produced by each, with increase or decrease in live weight and an analysis of the butter produced from each breed, together with a vast amount of other information, making the most valuable collection of data and facts concerning dairying ever compiled. The study of and deductions from the figures given can not but be of inestimable value to dairymen and those interested in farming.

All the tests were under the supervision of a committee, consisting of one representative of each of three breeds and four representatives of the Association of American Agricultural Colleges and Experiment Stations. The most elaborate precautions were adopted by this committee to secure absolute fairness and accuracy. That this end was attained is best shown by the fact that from no reputable source has the least doubt been cast upon the results.

This committee has made its official report to the authorities of the Exposition, giving such results as were necessary for the determination of the official rewards, and, having thus fulfilled its function of supervising the tests and certifying to the final results, has dissolved. In the course of its work, however, a vast mass of data was secured of the utmost value alike to the breeder, the dairyman, and the man of science. These data exist in the manuscript records of the committee, of which there is but a single copy. Only the merest fraction of them, in the form of summaries, such as were necessary for making the awards or as could be published in agricultural newspapers or the publications of the several breeds, have yet seen the light.

Moreover, while these data are complete so far as a record of the bare facts observed is concerned, they are but very little more than this. They constitute a rich mine of dairy facts, but until these facts have been put into their proper relations and carefully studied in all their bearings—until the crude ore has been refined and smelted so as to produce the pure gold—they must necessarily remain practically unavailable either to the public or to special students of dairying.

In view of the above facts we desire to offer to the Department of Agriculture the use of the original records of these tests, now in the custody of the chairman of the committee, for completion, copying, and editing, with the understanding that the completed manuscript record shall be held by the Department for its own use and for that of any student of dairying who may apply for it, under such restrictions as may be necessary to insure the preservation and safety of the manuscript.

We make this proposition with a view to rendering this material available, so far as practicable, to the dairy interests of the United States, and with the distinct understanding that all questions of publication be left for future consideration, and that the acceptance by you of this proposition in no way commits the Department to such publication.

Very respectfully submitted.

M. A. Scovell, *Chairman,*
Director Kentucky Agricultural Experiment Station.

I. P. Roberts,
Director Cornell University Experiment Station.

S. M. Babcock,
Chief Chemist Wisconsin Experiment Station.

H. P. Armsby, *Secretary,*
Director Pennsylvania Experiment Station.

H. H. Hinds,
Superintendent Shorthorns.

W. H. Caldwell,
Superintendent Guernseys.

V. E. Fuller,
Superintendent Jerseys.

The executive committee reported back this memorial with the recommendation that it be adopted, which was done.

S. M. Emery laid before the convention some correspondence between the Montana Station and the editor of an agricultural paper, regarding the value of station publications. This correspondence indicates a spirit of antagonism between agricultural papers and the experiment stations which, in the speaker's opinion, it is the stations' duty to disarm.

W. J. Spillman, of Washington, brought up, as unfinished business, the question of the relation of the station to farmers' institutes. He thought the greatest good to the farmers from the station came through the personal contact of these institutes, and that much benefit was derived from them in the way of stimulus and encouragement by the station workers themselves.

The Association then listened to the address of Prof. H. E. Armstrong, of London, England, this being the third series of biennial American lectures on the work at Rothamsted provided for by the Lawes Agricultural Trust.

The chair announced the following committee on nominations: T. F. Hunt, of Ohio; J. E. Stubbs, of Nevada; C. D. Smith, of Michigan; H. N. Starnes, of Georgia; C. S. Murkland, of New Hampshire; J. A. Myers, of West Virginia; W. H. Jordan, of New York; J. H. Worst, of North Dakota; F. E. Emery, of North Carolina.

Evening Session, Wednesday, July 14, 1897.

W. R. Lazenby, of Ohio, presented the report of the committee on uniform methods of seed testing, which embodies specific rules and recommendations for this work, adopted by the committee at Washington, D. C., January 20, 1897, and which has been published as a circular[1] of the Office of Experiment Stations of the United States Department of Agriculture.

The report was adopted.

Mr. True read a paper on "Advertising in experiment station publications," as follows:

Advertising in Experiment Station Publications.

The opinion which one will hold regarding the propriety of introducing into the text or illustrations of experiment station publications what are really or practically advertisements will naturally depend upon the ideas regarding the proper functions of such stations. This complicates the matter to a considerable degree, since many of our stations are complex institutions receiving their funds from different sources, being operated under different laws. All of them, however, are public institutions, and as such, I suppose it will be granted, should be conducted on a different plan from what might be proper for private institutions. The general rules of management which are ordinarily held to apply to public institutions will, therefore, apply to our experiment stations. The general theory which we hold regarding public institutions is that they are to be conducted impartially for the public good, and in such manner as not to intentionally favor particular private parties or enterprises.

The experiment stations organized under the Hatch Act and supported exclusively by the national funds have a wide range of work so far as the subjects which their operations can cover are concerned, but under the law their functions in certain directions are, strictly speaking, much more limited than many have supposed. As stated in section 5 of the Hatch Act, the money appropriated by Congress for experiment stations is "for the purpose of paying the necessary expenses of conducting investigations and experiments and printing and distributing the results." It was not intended by the Hatch Act to establish general bureaus of information on agriculture, but institutions devoted to experimentation. Routine operations involving expert or scientific knowledge, such as the analysis of fertilizers, or police duties, such as the repression of diseases of animals or plants, were not provided for in this act. It is true that in some cases the stations have been compelled to publish compiled information or to do other things which are not strictly contemplated by the act, but it is in my judgment a great mistake to favor or maintain indefinitely a kind of station policy which tends to turn the stations into mere bureaus of infor-

[1] U. S. Dept. Agr., Office of Experiment Stations Circ. 34.

mation. State boards and commissions of agriculture should be established for these purposes, and the stations should give their attention to original investigations. Especially should the Hatch fund be kept as a trust fund given for the special purpose of securing for the farmers of the country the benefits which can only come from thorough and original work along scientific lines in behalf of agriculture.

Station work and policy needs to pursue an upward rather than a downward grade in this country. Rather than assume new responsibilities and functions, the stations would do well to labor earnestly to have their business restricted to its legitimate channel. Advertising in any form is at the best a thing of doubtful repute for a public institution to engage in. I am unable to see why any station organized under the Hatch Act should desire to assume the responsibility for such a thing when it is perfectly easy to take refuge in the plea that the law did not contemplate such work.

As institutions organized under State laws and supported at least in part by State funds, a number of our stations have been charged with certain police duties, e. g., the analysis and inspection of fertilizers, and the inspection of dairy products and nursery stock. Such work necessarily brings a number of private commercial establishments under public control, and limits the liberty of such establishments in definite directions. This introduces a new principle which must govern the relations of the stations with such establishments as compared with other private concerns not subject to inspection. The facts relating to the inspection of the establishments coming under the supervision of the station must necessarily be matters of public record. The establishments deprived of perfect liberty in their actions are entitled to the compensatory advantage of public guaranty for their business if satisfactorily conducted. This removes the published statements of analyses of commercial fertilizers and other inspected agricultural materials from the ordinary category of advertisements. If certain concerns get some advantage from these publications, it is because the people have by law ordained that this shall be so.

The publication of the results of formal tests of different kinds of farm implements or apparatus would also seem to be admissible, provided a general opportunity had been given for makers to enter the competition, and the tests are along lines of public interest. It must, however, be said that many so-called tests of apparatus or implements have been so ill-considered and incomplete that their results were neither reliable nor worthy of publication. It would seem as if tests of this kind, if made at all, should be conducted so thoroughly that all doubt of unfairness or incompleteness would be removed. Whether this can be done at our stations as ordinarily organized, may well be questioned. While there are so many things that stations may do without exciting any criticism, it is difficult to see why they should undertake tests of apparatus and implements when they have neither experts nor appliances for such work. I hope that some time we will establish some stations in this country after the pattern of the station in Paris especially devoted to the tests of farm implements. Then there would be some real opportunity to study the principles on which such implements should be made, and to devise thorough and adequate tests.

The real objection, however, to advertisements in station publications lies against the recommending of miscellaneous manufactured articles used by farmers which have not been the subject of experiment or investigation by stations in any true sense. As a rule these things are advertised because the station officer thinks it would be a good thing for the farmer to know about them. He has formed his opinion from general hearsay or from his own limited experience. When he makes a publication of this kind it seems to me he virtually abandons his position as a scientist or investigator to become a purveyor of miscellaneous information obtained more or less at haphazard. He runs a great risk of being mistaken in his opinion, and may be subject to great and unnecessary temptation to favoritism. Especially in the case of patented articles it may easily be made to appear that he is working in the interest of some individual company or trust. Oftentimes the real differences in construction and utility between machines or articles of different manufacturers are comparatively slight. For instance, take bicycles. Who is prepared to say which is *the* best kind? It is usually the one *you* ride.

Why subject the station to severe, even if in some respects unfair, criticism for departing from its proper limitations as a public institution when, as a rule, this is, to say the least, unnecessary? This is, of course, a practical question, and we must not draw too fine distinctions, but I am persuaded that in almost every case where advertising has been introduced into station publications statements more or less general in character would have answered just as well and the charge of favoritism have been avoided. Even in the matter of illustrations a little ingenuity will secure the publication of the information which is really desirable without the use of the cuts furnished by the manufacturers.

If we must have advertisements, if the demand on the stations to insert them in their publications is so great that it can not be resisted, then let us adopt the system followed by our thrifty mother country and her colonies, and admit advertisers to

our public documents on the same terms as they are now admitted to our newspapers. Without doubt the large circulation of our station publications would secure a wide range of agricultural advertisements at remunerative prices. We might thus have more money for experimenting and the farmer would find out where he could buy what he needed, and the station officer would be relieved from the odium which now attaches to advertising in station publications.

Morning Session, Thursday, July 15, 1897.

Mr. Harris presented the report of the committee on a collective exhibit at the Paris Exposition, as follows:

Your committee, appointed to consider the desirability of a collective experiment station exhibit at the Paris Exposition and to recommend a plan for its preparation and care, beg leave to report that they have considered carefully the matters referred to them and are of the opinion—

(1) That a collective experiment station exhibit at the Paris Exposition is desirable.

(2) That such an exhibit is practicable, provided the Association can obtain from the Office of Experiment Stations assistance in the preparation and care of the exhibit, and in the payment of the expenses, upon a plan like that on which the Chicago exhibit was prepared.

And your committee recommend—

(1) That the executive committee be directed to confer with the honorable Secretary of Agriculture to determine what assistance the Department of Agriculture will give.

(2) That a special committee of five persons be appointed, of whom the Director of the Office of Experiment Stations shall be one, to prepare the exhibit.

(3) That the executive committee be instructed to pay the necessary expenses of the special committee.

A. W. Harris,
W. H. Jordan,
M. A. Scovell,
W. M. Liggett,
Committee.

The report as presented provided in its second recommendation for the appointment of a special committee of five by the executive committee, Mr. Harris explaining that the object of this method of appointment was to enable the executive committee, which was frequently called to Washington, to confer with the Secretary of Agriculture as to the possibility of securing aid from the Department, and avoid the expense to the Association of the special committee's taking such a trip. To this Mr. Goodell objected, on the ground that the matter required immediate attention, and the sooner a plan was formulated and put in operation the better. He moved to amend section 2 by striking out the words "that the executive committee be directed to appoint a special committee," so that it would read "that a special committee of five be appointed." This was adopted.

The question being upon the adoption of the report as amended, Mr. Northrop said:

"I do not care, as to this particular question that has been raised, whether the executive committee does the work or the special committee to be appointed; but for one I do not wish to go into an exhibit of stations at Paris or anywhere else simply because there is to be an exposition there. I have had some experience with exhibits at New Orleans and other places, and I appreciate the fact that it is exceedingly difficult to find anything worth exhibiting in such a connection, while the benefit derived from it is exceedingly small. It involves, moreover, a great amount of trouble and worry, so that I seriously raise the question, notwithstanding the committee has doubtless looked at the matter carefully, whether it is best for us to go into this matter of an exhibit of the stations. When the matter is settled that we shall go into it, then there will be hurry and scurry all along the line to see what can be exhibited, and if gentlemen will look at the situation at their homes and ask themselves what they have to exhibit, I think they will appreciate the difficulty of the situation. Of course it is possible for us to make drawings and things of that kind, but unless the result is likely to be more promising than now appears I should

think it unwise for us to make a special exhibit of the stations. The stations are for work, and the most effective work is most difficult to exhibit. You can exhibit some things, generally the smallest things, but you can not exhibit the progress of intellectual life that is going on under the processes of education, and there is no use trying. Your best work and your best results you can not possibly exhibit. You can exhibit a lot of secondary and inferior details, drawings, and things of that kind, but in the immense mass of material that is shown at such an exhibition the whole thing is likely to be lost and overlooked and make but little impression. Unless I am shown, first, that we have something very desirable to exhibit, and second, that the results are likely to be compensating, I shall feel constrained to vote against the exhibit itself. If I am convinced that corresponding results equal to the forces expended and satisfactory in their nature will come, then I am ready for the exhibit, but I raise the question as to its utility now."

Mr. Canfield confessed to feeling very much as President Northrop had expressed himself. He doubted whether the stations were in condition to make a creditable and worthy showing of the work they had done, and agreed with Mr. Northrop that it was impossible to exhibit the best work of the stations. He thought the committee to be appointed should take this question into consideration.

Mr. Washburn thought the stations ought to be represented at the Paris Exposition. At the exposition there in 1889 and at the World's Fair in Chicago he had spent much time in studying the exhibit of the experiment stations and derived much benefit from it. There is a great deal of material and a great many facts which can be exhibited in the line of photographs. Take, for example, Professor Armstrong's address on the Rothamsted experiments. The photographs shown by Professor Armstrong in his lecture illustrated how much better it is to look at results than to study them in books. Most of the experiments in farm crops and in similar lines can be well exhibited in photographs. Anyone who had studied the exhibit at Chicago, he thought, would feel sure that it conveyed a vast amount of information.

Mr. JORDAN. The question, it seems to me, reverts to the one as to whether world's fairs are desirable. If they are, and the American people are to take their place in the exposition at Paris alongside of other peoples, I decidedly object to the experiment station system of this country being unrepresented. I feel that there is something more in this than the mere matter of the exhibit. I know that when I undertook to aid in the preparation of the station exhibit at Chicago I desired to find out whether there were any great facts discovered that I could present, and I immediately began to look around for what I and other men had done that was worth exhibiting. It may enable us to see ourselves as in a glass when we come to look around for what we have that is worth presenting. More than that, I trust that with the most magnificent experiment station system in the world, Americans will not be obliged to travel around through the Paris Exposition and ask, "Where are the American experiment stations?"

Mr. TRUE. The Department of Agriculture will not be able to move in this matter until Congress has taken action. I understand that there is a bill now pending making appropriations of some three-quarters of a million dollars for the Government exhibit at Paris; but that bill has not passed, and may not pass until next winter. On the other hand, when this matter is presented to the Secretary of Agriculture it would seem desirable that some definite scheme for the exhibit, at least in its general outlines, should be given in order that he may know what is proposed, and that the Department, when it receives its share of the money, may decide what assistance it will be able to give. For that reason I think it quite desirable that there should be no delay in the appointment of this committee and its getting to work to formulate a plan.

Mr. True, in speaking on the general desirability of making an exhibit at Paris, mentioned a visit he had paid to the Millennial Exposition at Buda-Pesth, where a very good exhibit was made of the agricultural colleges and experiment stations of

Hungary. He got from this exhibit a much more definite idea of what these institutions were doing than he could have formed in the same time in any other way. He felt sure that an exhibit of this kind at Paris would impress the work of the American experiment stations much more definitely than it is now impressed upon students of agriculture all over the world.

Mr. HARRIS. I agree entirely with what has been said as to the difficulty of making an educational exhibit. The things that may be shown are inevitably unimportant things. We need, however, to make a distinction between an exhibit illustrating methods of education and instruction and an exhibit to show the results of investigation. I think the complete answer to the question whether we may exhibit anything of value is found in the experience we had at Chicago. Anyone who studied that exhibit will understand that we have ready to hand a plan which, with slight variations, will furnish the basis for an interesting and instructive exhibit at Paris. A few of the advantages of making this exhibit are: The benefit we hope it will be to the farmer; the advantage of explaining and clarifying the notions that foreigners have of our work, and thus facilitating that cooperation between investigators in this country and abroad which has been so difficult to bring about; and finally in enabling us to make clear in our own minds the work we have been doing. I believe an exhibit of this kind will be of value because it will help us to find out what we have accomplished. Then we should remember that the material which goes into such an exhibit is valuable when it comes home—valuable for our museums, valuable for instruction, and valuable because it is of use in presenting our results to the public. For these reasons it seems to me very desirable to make this exhibit at Paris.

The report was thereupon adopted. The Chair subsequently appointed the following committee to take charge of the matter: H. P. Armsby, of Pennsylvania; A. W. Harris, of Maine; W. H. Jordan, of New York; M. A. Scovell, of Kentucky, and A. C. True, of Washington, D. C.

H. W. Wiley, of Washington, D. C., then delivered an address on the sugar-beet industry in the United States. He sketched the history of the manufacture of sugar from beets in France and its establishment in this country, following this with a series of lantern slides illustrating the sugar production of the world, of the United States, and the relative proportions of cane and beet sugar produced. Illustrations of the sugar beet itself were shown, and the process of manufacture described in detail, illustrated by slides showing the machinery used in the various operations. He discussed the operation of tariff laws as affecting the production of beet sugar, and outlined the probable extent of territory in the United States in which the growth of the sugar beet would be profitable.

In answer to a question Dr. Wiley stated that there is no way for the farmer to extract the juice of beet sugar and ship it in bulk to some central point. There is no cheap way to make beet sugar; small plants will not do. Pipe lines to carry the juice to a central factory would do, but there is no cheap way for the farmer to extract the juice in a small way.

Mr. Hicks, in this connection, called attention to a possible source of profit to the farmer in raising beet seed. Practically all beet seed is now imported, and much of its vitality is lost in transit. He thought that the raising of seed for sugar beets might become an industry of some importance in this country.

Mr. MacLean presented an invitation from the governor of Nebraska, seconded by the faculty of the University of Nebraska and the council and staff of the experiment station, for the convention to meet in 1898 at Omaha, setting forth the advantages of visiting a great agricultural State during the holding of a great exposition at a central point. Mr. Washburn stated that he, as secretary, had received a duplicate of Mr. MacLean's letter from the governor of Nebraska, and also a letter of invitation from the Commercial Club of Omaha, which he read. A letter of invitation from the Trans-Mississippi and Continental Exposition Company to meet at

Omaha was also read. Mr. Ellis moved that the invitations received be referred to the favorable consideration of the executive committee, and the motion prevailed.

In the absence of C. W. Dabney, jr., chairman of the committee on farmers' institutes, W. H. Jordan submitted the following report, which was adopted:

Report of Committee on Farmers' Institutes.

The committee on farmers' institutes, to which was referred the paper presented to the last meeting of this Association, by Prof. John Hamilton, of Pennsylvania, begs leave to submit the following:

Your committee recognizes the great need of coordinating and digesting for popular use the mass of data bearing upon the practice of agriculture which has accumulated in recent years.

Your committee is not prepared, however, to indorse the plan so ably presented by Professor Hamilton, for the following reasons:

(1) There is at present a very hopeful activity in the writing of books which place recently acquired knowledge within the reach of farmers in a popular form. Several important subjects have already been treated successfully through private authorship, and more matter of this character is promised for the near future. To those who are eager for information there is even now available a large amount of useful literature. The possible farmers' library is not now wholly disproportionate to the farmers' capacity, and if any serious gap between supply and demand exists it is being rapidly narrowed through the publication of bulletins of information and books.

(2) The production of the literature which is suggested can scarcely be accomplished except through the same general means as those employed by publishing houses, viz, an arrangement with men of special training and ripe experience who are best fitted to discuss the various subjects important to the farmer. If such men are not enticed into authorship through the inducements which publishers are able to offer, there is little hope that they would transfer to governmental use their services and all claim to the product of their best study and thought.

(3) It does not appear feasible or justifiable for the Government to print and store large editions of books with which to supply a future uncertain demand. This would involve great risk of a wasteful use of funds and in any case would require the maintenance of a commercial book business which appears to your committee to be at least an unwise application of the functions of government.

(4) It may be urged that the production of such literature by the Government is simply a logical extension of the work now being done by the Office of Experiment Stations. It should be stated in reply that the publications of this office are either intended merely as an aid to the stations in the prosecution of their work or are based directly upon results which the stations have secured. Such assistance and organization of data are simply a means of the departmental aid required by the Hatch Act.

(5) If we consider the large amount of costly editorial and printing work which the Department of Agriculture has already undertaken, some of which is still in the process of development, it does not seem feasible for it to attempt in addition this great effort that is proposed.

To enter upon the publication of books of general information that are not required in the prosecution and presentation of the work of the Department would not only be looked upon by many as an unwarranted exercise of governmental function, but would be regarded by book publishers as clearly trespassing upon the field of private enterprise.

Your committee is inclined, therefore, not to favor a step which would embarrass the Department of Agriculture with new problems, and which would certainly subject it to widespread and severe criticism, whether justifiable or not.

W. H. Jordan.
W. A. Henry.

Mr. Henry, from the Section on Agriculture and Chemistry, reported the following definitions of terms to be applied to feeding stuffs, with the recommendation that they be referred to the committee on nomenclature, which was adopted:

The term "concentrates" applied to that portion of the ration commonly designated as "grain feed." It embraces such feeding stuffs as corn, bran, oil meal, and in general the more concentrated portion of the ration.

The term "roughage" applied to the coarser portion of the ration, and including such feeding stuffs as hay, corn fodder, silage, and roots.

By the use of these terms we may conveniently group the components of a ration into "concentrates" and "roughage."

H. L. Bolley, of North Dakota, presented the following paper:

An Experiment: its Conception and Methods of Procedure.

I have a clipping from a so-called agricultural paper which reads as follows: "The State experiment stations are each expending something like $100,000 a year in teaching agriculture in their respective Commonwealths, and the taxpayers are paying the freight; but I doubt if one of these establishments is doing as much good as one agricultural journal, the expense of which ofttimes is carried by one individual. The papers are at it continuously, and the work goes on forever, like the water which turns a mill, while an agricultural college receives great praise for getting out four measly little bulletins a year, and some of these are so technical as to be utterly useless to the ordinary reader."

It is not this sort of criticism which should trouble station men, for its evident purpose, errors, and general misconception of the purpose of station work destroys its force: but we are concerned that so much of such criticism exists. In some respects it is not without point, for if there is misconception on the part of station men as to the purpose of these Government institutions, it must be quite certain that others will accumulate misconceptions also. While the experiment stations are accomplishing work, in value, far in excess of the cost, yet much work is undertaken by them which is not of their business. This leaves many to believe that things sometimes are not well done, which, in reality, might better be criticised as not relative to the work of an experiment station at all. The only way to disarm such criticism is the one which leaves as slight room for misconception of the station's purpose as is possible to select. This way is clearly pointed out in the name of the institutions and in the wording of the organic law. It is not necessary to repeat that wording. We must experiment and we must publish. The latter type of work is valueless without the first process.

Which is the most important phase of the work, then, is evident; and definiteness does not set a very general conception upon the word "experiment," a deliberate act undertaken in order to make plain the features of some unrecognized fact, or to illuminate those of a known one. An experiment has its basis in a fact of condition in nature; hence if one wishes to make an experiment, he must commune with nature, and the first work should be strictly mental, concerning itself in attaining a proper conception. A series of such questions as the following put to one's self would have saved many a so-called experiment to a more to be preferred fate. Does the supposed condition invariably exist in nature? Does it depend upon conditions which are foreign or unnecessary to the normal, or accessory to the normal? If certain as to the last status, does it depend upon one such condition or upon many? If the latter is true, upon which condition falls the primary cause, etc.? If in the future each experiment-station worker should follow such a course of questioning, we would have less types of work labeled "An experiment."

Following closely upon such questioning, the purpose of the experiment should be clearly established; and a thought of the need of the accomplishment of lasting results ought to lead one a long way upon the right road; for surely such cost as that occasioned by the experiment stations ought not to be for temporary purposes only.

While abstract investigation for abstraction's sake is hardly to be recommended in American institutions, the economic purpose never alone rules the work of a scientific investigator so as to lead to best results. There is yet an abundance of questions the solution of which directly bear upon the economics of agriculture; but if the experimenter can not see his way clear to answer some one of these, he had better investigate a little for pure science sake, rather than to betake himself to the construction of another bulletin, which is more liable to be taken for a pamphlet illustrating some new method of university extension work for farmers than to be read as representing the work of an experiment. Thus it seems essential to establish in one's mind a purpose. To clear the way for this, one should form for himself a clear definition of the work to be undertaken, then ascertain its status as to features already attacked by other investigators. Often, when this is properly done, one finds that he has no basis for an experiment at all, or that the work left for him to do becomes more clearly outlined in his mind, thus enabling him to put upon record a complete course of labor, to be completed, and a statement of the results to be anticipated, including a summary of conditions liable to introduce error of method or of conclusion. An observance of this sort of forecast tends to make an experiment properly exclusive, inclusive, and conclusive; and one is led to the further thought that the aim of an experiment is, primarily, to enlighten the experimenter.

This leads us to a consideration of the relation of the experiment to education. I think it may be said that this does not properly concern the individual experimentalist, but that the whole question is better referred to the executive or administrative department, to be determined as a matter of station policy—just how far

the station shall use its means for purely educational purposes. The attempt of the average experimentalist to popularize his work is usually a costly venture, and constitutes a real drain upon experimental energy. Experiment-station men, like those who succeed in other professions, should stick to their business. It seems to me to be irrational to compel an experiment in its infancy to do educational work. Again, it is a waste of precious time when an able educator undertakes to do the work which good farmers can do as proficiently, if the educator will, considering the work of experimentalists, but tell them how. This is not intended to affirm that experimentalists are always failures in the educational line, or vice versa; but rather to affirm that, properly, the two types of work should be separated. If this is correct reasoning, it is apparent that the "model" farm, garden, creamery, and all-round exposition method of running an experiment station is bordering closely upon a misappropriation of means. This I argue not from the technical side of the proper use of funds as demanded by the General Government, but as respecting the attainment of the most lasting results. If, after a course of years, a given experiment station may only point to the fact that it has kept a better looking farm, raised bigger crops, a better garden, and finer stock, and has exhibited to the people a finer line of farm specialties than any other as expensively conducted establishment in the State, its director will discover that the institution is not widely known as an experiment station, and the people of that State, who have a right to expect something new and lasting to aid them in their work, will still be wondering what that station has done with the moneys intrusted to its care. Such a station will be nothing less than an entire failure.

This tendency to prostitute the experimental idea to the one of the "model-farm" type, to the educational one, arises, I think, in a misconception of the relation of the experimenter to the common or average farmer. The demand of the weak or even of the average farmer should not be the gauge of an experiment. It is not to such that science readily appeals, but to him who is ready to receive. This last type of farmer is the leader in a community and must not be disappointed, for if properly stimulated and aided he becomes a second experimenter and his neighbors of less advanced thought copy his methods, and education becomes complete. There is, however, a rational middle ground within every such question, and this paper is in no way intended to mitigate the criticism which should properly fall upon the experimenter who does not at all times have his work so well in hand that its appearance shall constitute a real model of farm method and excellence.

If the "model" method is expensive, the exhibition method is an even more pernicious drain upon the means of legitimate experiment. This hits the work from various directions and hails from all departments of experiment-station work. I cite but one phase—the large and burdensome garden for "variety testing." You have all seen it. Most stations are blessed with gardens so large they can not sell the produce for fear of the rage of the local gardeners. It is all accredited to variety testing, a sort of exhibition method some local horticulturists have of astounding the local enthusiasts. By way of making the point more expressive, I quote from a recent bulletin by Prof. L. H. Bailey upon the purpose of variety tests. He says: "In such cases the exhibition is to show cultural methods, not to show varieties." Speaking of his careful method of making observations upon such tests, Professor Bailey says: "This means that we desire to do more, if we can, than to make mere variety tests. We should like to keep pace with the range of variation, the tendencies and the needs in any plant which we study. We have no desire simply to recommend varieties. We have no interest in a variety as such."

This "variety testing" for exhibition purposes, as an error in experimental conception is only equaled by the Congressional distribution of farm and garden seeds. In another type of variety testing, however, there is an easy second, known as "acclimatization tests." These tests consist usually of a large acreage of shrubs and small fruit trees, planted apparently to ascertain how many will die. Yet one seldom hears that any special study has been made of the causes which have instituted the dying, or even the more primary feature as to whether any plant was ever artificially educated to live under a range of conditions wider than that of its native or specific range.

Experience seems to show that in proportion as experiment stations begin to assume a standing for good work these large-scaled, primitive show methods have previously been superseded by more detailed, thought-engendering efforts of real experimental work, upon smaller ground plans, and directly related to laboratory methods. Such stations are found to be stations with farms attached, not farms with an experimental annex.

Thus, in the conception of an experiment one should define well its limits; and its mechanical proportions are worthy of immediate attention, that by them one shall not be carried beyond his efficient powers of observation. By way of illustration, I have but to call attention to the past efficiency of water and pot culture methods, aided by laboratory, chemistry, and botany, and final field tests, as against field

methods for like purposes. The field of experiment seems to be of details, not of generalizations. We can not all hope to attain the scope of view recognized in a Thomson, a Pasteur, or a Darwin, nor have such men usurped the entire field when they have perfected and set forth their great generalizations. Thus Lord Kelvin, when speaking, I assume, in terms of generalization, could, perhaps, but two years since, quite rightly say that he had learned nothing new in the past fifty years concerning the nature of energy; yet it is grossly incorrect as indicating the progress in detailing the facts of energy. In that fifty years, through the agency of detailed experiments, there have come to light all those minor features of the working effects of energy which have supplied a knowledge for the advancement of mechanical, physical, chemical, physiological, and psychological science, such as, I doubt not, the great mind of Lord Kelvin could scarcely have dreamed of so long ago.

A consideration of the qualifications of the experimenter is not within the confines of this subject, but it may properly be said that to succeed one should make use of every available power, among which, for purposes of experimental conception, none is more effective than a wide-range imaginative faculty. Here in the initiation of the experiment is the place to turn it loose. It will give one all sorts of surmises and glimpses of prospective success and of possible errors. Lord Bacon has said: "The man who is young in years may be old in hours." I think that it will be found upon studying the lives of great experimentalists that they have been, however old in years, young and active in bright imaginings.

Thus prepared for the work, there is but little to be said concerning methods of procedure, for, in chief part, the work is now a rigorous pursuit of the purpose, aided by open-mindedness, clear perception, and pure reason. From the beginning of this phase of the work the imagination should be chained and conservatism should rule. The feature of method should be the attainment of such exactness in each element of the work that conclusiveness of result must of necessity follow. Farm questions are not easily solved by mere methods of practice, else ages of it should have resulted in more perfect elucidation of many common questions. For these more abstract research is needed and must be given freely before lasting methods of practice may be attained.

Many citations might be made indicating effective changes from so-called "practical" or farm methods of experiment to those of the laboratory, but this is unnecessary. It is easily discernable to any experimenter that after a fact of nature is pointed out which contravenes against present "practical" methods the experimenter needs to go but slightly further. Less valuable labor than his can complete the work; for error falls of its own weight or quickly fades before the light of fact. Thus call to mind the effect upon cultural methods of the light of a few well-known botanical studies, as, for example, the demonstration of the nature of the following plant diseases: Grape diseases in general, smuts of cereal grains, fire blight of fruit trees, and the various well-known potato diseases; or further, consider the less evident knowledge upon the following questions: Ascent of sap in trees, cellular absorption, natural methods of seed distribution, fermentation, plant fertilization, and the principles of seed selection. Note also the names of men great in the fields of physical science: Thomas Young, on the undulatory theory of light; Sir Humphrey Davy, Hans Christian Oersted, André Marie Ampére, Gauss and Weber, demonstrating the interrelation of galvanism, magnetism, and electricity; Count Rumford, J. Prescott Joule, and von Helmholtz, upon the conservation of energy; and Sir William Thomson upon the dissipation of energy. These men allowed no detail of an experiment to escape their exact method of reasoning and of examination; or if it be said of some of them that their renown is greater in generalization than in the field of exact experiment, then it must, at least, be said of them that they allowed no needed fact of detailed experiment to escape them. So also with the experimenter who seeks success in a narrowed field of research; he must let no opportunity for observation upon the different features of his experiment escape him, and here few should depend upon memory. A record should be made at the time of observation; and the afterstudy and making a duplicate often repays the cost of labor by the awakening of new thoughts.

Publication is the final step of making permanent record of the work. It should be none the less concise than the work that has gone before, and should record all scientifically attained results, unconfused by extraneous features. If popularization is a necessity it is not the work of the investigator, and in no case should it be attempted when detailing the results of an initiative study. For the sake of future investigators and for the interest of the leaders in agriculture, I feel that it is not out of place at this time to protest against the encyclopedic method of bulletin construction, whereby wholly different or irrelevant subjects are discussed in the same pamphlet. It seems to me that the bulletin idea must have originated in the wish to be concise. Often, of course, there is valuable matter for publication too limited to occupy a single pamphlet; but I contend that when a bulletin is constructed of miscellanies the separate articles ought, at least, to be so related as to

concern only one phase of agricultural education. As to technique, it should conform to usage in language. In detailing an account of an initial experiment the best wording in the language of the people for whom it is published is none too good. In making this statement I see no distinction between so-called technical and popular wording: for a publication which is written so as to require an expert either in the technique of some science, or of the vernacular of some farming community, to interpret it, is very poorly written. Those who insist upon the popular type of bulletin also make a mistake in the principles of education by slighting the ability of the intelligent farmer who could help to educate the people. Writing an error or misnaming a fact is not popularizing, but butchering language and science.

In conclusion, to make complete success of an experiment, let it be a point of continuous remembrance that all law is one, and that every fact in nature, positive or negative to the theory of the test, is an acquisition the attainment of which is much to be wished.

Mr. JORDAN. The essayist has touched two points that come pretty closely home to me as an administrative officer. I inherited an experiment station a year ago, and found growing on the station grounds some 3,100 varieties of plants, chiefly fruits. I know what has been said about variety tests, and I know something of the sentiment that exists on that subject. I have all my life shared in the feeling that a great deal of money has been wasted in variety testing. So when I came to the experiment station, with its 3,100 varieties of fruits, I did some thinking about the advisability of that work, but have been a little slow in coming to any conclusions. I have found these conditions: a tremendous fruit interest in the State of New York and the nurserymen intensely interested in varieties. We have every day during the season a large number of people who come to the station and take great interest in studying that large number of varieties. Under these conditions I feel rather reluctant to sweep out of existence that great museum of living fruits. Moreover, I have found this year, as we find every year, that we are freely attacked by fungus diseases and insect pests. Our entomologist and our plant pathologist find at the station in the study of fungus diseases and insect pests opportunities right there under their eyes which they possibly could not have as efficiently in any other way.

Mr. TRUE. I wished to ask, as a result of your study of this matter, what lessons are really taught that are truthful and exact regarding these varieties by such a test as is made on your grounds, and what facts that are not local in their nature are brought out? How far do the results of these variety tests at Geneva apply to the horticulture of your State as a whole; and when one comes and observes these things at Geneva, what truthful lessons does he get regarding these varieties?

Mr. JORDAN. I do not want to be put in the attitude of defending the grosser forms of variety testing. Now to answer the question, which is a pretty hard one. I am trying to see the matter somewhat through the eyes of such men as S. D. Willard and W. C. Barry. I am hunting for the right thing to do. These men tell me that the station work along these lines has had an important influence upon the use or disuse of good or bad varieties in western New York. It is, I confess, quite a local influence, but when we consider what western New York is, the local influence amounts to something important. Professor Beach feels that this variety collection gives him an opportunity to study certain general principles in botanical horticulture along these general lines which he would not as readily have in any other way. I regard this collection of fruits as largely valuable for its related lines of research as well as a direct variety test. I may reverse this decision; I wish simply to open to you the perplexities in my mind.

Now, one word more as to popular bulletins. The New York Station has just started out to issue popular editions of its bulletins. I do not believe with the style of bulletin which the New York Station has issued there is one farmer in fifty who gets much of value out of them, and I have concluded that it would be better for us to publish bulletins in which all the data we collect are plainly stated and in readable form, so that the people of New York may profit by the information we gather. For this reason I have employed a station editor to popularize the technical

reports of the heads of the different departments of the station and to furnish newspapers with authoritative abstracts of these reports.

Adjourned at 11.30 a. m.

Evening Session, Thursday, July 15, 1897.

H. J. Waters, of Missouri, for the Section on Agriculture and Chemistry, read the following report on uniform fertilizer laws:

Report on Uniform Fertilizer Laws.

At a regular meeting of the Section on Agriculture and Chemistry, held Tuesday, July 13, 1897, it was ordered that the recommendations of Messrs. White, Armsby, Woods, and Wiley, in reference to the needs for more uniform fertilizer laws in the different States[1] be approved and recommended to the favorable consideration of the convention in general session.

And it was further recommended that the president of this Association appoint a committee of five to confer with a similar committee from the Association of Official Agricultural Chemists, with a view to devising some general plan for the accomplishment of this purpose; said committee to report its recommendation to this Association.

Mr. Waters moved the adoption of the recommendation carried by the report.

Carried.

The chair subsequently appointed the following committee in accordance with the recommendation: H. J. Wheeler, of Rhode Island; H. P. Armsby, of Pennsylvania; C. D. Woods, of Maine; E. H. Jenkins, of Connecticut, and M. A. Scovell, of Kentucky.

G. H. Hicks, of the United States Department of Agriculture, presented the following resolution:

Whereas one of the principal requisites of successful agriculture is the use of seed for sowing which is free from obnoxious weeds, of good vitality, and true to name; and

Whereas there are thousands of pounds of trashy seed annually imported into and sold in the United States, especially seeds of grasses, clovers, and other forage plants; and

Whereas at the present time the agriculturists of this country frequently labor under great disadvantages in obtaining pure germinable seed, thereby entailing extraordinary loss and trouble; therefore, be it

Resolved (1), That this Association earnestly recommends that some practical instruction in seed testing and seed investigation be offered at each of our agricultural colleges, and that the experiment stations equip themselves for investigations in seed testing, following, so far as may be found practicable, the rules and methods adopted by this Association and published in Circular 34 of the Office of Experiment Stations.

(2) Furthermore, we recommend that one or more lectures on agricultural seeds, and the best means for ascertaining the real value of the same, be given at our farmers' institutes, and that the importance of this subject be urged upon all suitable occasions.

(3) We heartily indorse the efforts of the United States Department of Agriculture, by means of its pure-seed investigations, to secure an improvement in the quality of agricultural seeds, and we recommend that the experiment stations and agricultural colleges cooperate with the Department in this work.

The report was adopted.

Mr. Hicks. I think the importance of this subject is patent to all. There is a growing sentiment in the country in favor of better seeds and better and more uniform methods of testing them. There is also, I think, a growing desire on the part of the farmers of the country to have some ready and efficient way of securing knowledge in regard to the value of the seeds which they shall buy. There is also, in some quarters, strong pressure for the enactment of seed legislation, and a great desire to have reputable seedsmen guarantee to their customers that their seeds shall come up to certain standards of purity and vitality. The great drawback

[1] U. S. Dept. Agr., Division of Chemistry Circ. 3.

heretofore to securing such guarantees has been due to the fact that there has not been enough work done, and the methods have not been uniform enough to make the seedsmen willing to give such a guarantee. Furthermore, until the stations take up this work in a thorough, scientific, and efficient manner, we are not prepared in this country to make any recommendations for legislation, which is at best only a means of last resort. It is much better to secure the desired end through other means, and the pressure of public sentiment. I trust the Association will consider this an important matter and cooperate with the Department of Agriculture in this work. I will conclude by saying that Secretary Wilson, whom you all know to be an efficient experiment-station worker himself, is anxious that the Department shall be entirely in line with the experiment stations in conducting all experimental work, and especially in this matter of securing better quality of seeds.

Mr. Murkland then presented the report of the committee on the proposed engineering experiment stations. This report contained the draft of a bill to be submitted to Congress establishing engineering experiment stations in every State and Territory and appropriating $15,000 to each for the maintenance of such a station.

After reading the report, Mr. Murkland moved that the executive committee of the Association appoint an auxiliary committee of five to cooperate in the further elaboration of the bill and the prosecution of its interests. The committee appointed in conformity with this motion is C. S. Murkland, F. P. Anderson, M. H. Buckham, A. W. Harris, and J. E. Stubbs.

Mr. Murkland. There are only one or two points in this report on which stress need be laid. It was of course impossible for any committee to prepare a report to the convention and draft a bill which should not present in every section suggestions to every mind in the convention. There are undoubtedly numberless points occurring to your minds where this report could easily have been improved upon. I am very sure there is not a member of the committee who could not take this draft and to his own satisfaction, with more time, present one far more satisfactory to him. Indeed, as a committee we have not had time to formulate a perfectly satisfactory draft of the proposed bill, but simply indicate, so far as might be possible, what seemed to us to be the common feeling regarding the expedient thing to do. The two points I mentioned are, first, that Congress has enacted that there shall be in each State one institution at least which shall in a peculiar sense be the expression of the purpose of the Government to educate the people in the industrial arts; secondly, that—this first point being granted—there remains only the need of an act by which this purpose may be carried out to full and symmetrical completeness. As we have colleges for instruction and as we have experiment stations for investigation in agriculture, we should have experiment stations for investigation in the mechanic arts. Moreover, it is probable that the time has come for some action of this sort—perhaps not the time when the bill shall be easily passed, but a time when this Association can with perfect courtesy urge upon Congress the completion of its own work. Without further preface, therefore, but with perfect willingness to answer any questions that may be asked, I submit to you this report, and move that the recommendations of the committee be adopted.

Mr. Emery. Does the resolution carry with it the recommendation of the passage of this bill, substantially as read?

Mr. Murkland. The adoption of the recommendation of the committee commits the convention to the adoption of something in the main like this bill.

Mr. Emery. It seems to me unwise to recommend such a measure, because it practically creates another association which will rival our Association. Nor do I think it necessary to appropriate $15,000 annually for engineering schools alone. I believe we can better accomplish the object sought by asking for a less amount of money.

Mr. Henry opposed the motion on the ground that it asked botanists, chemists, agriculturists, etc., who had nothing to do with engineering, to work for the passage of a purely engineering bill. As an agricultural professor, he felt that he had no

right to vote on this matter. In view of the Government's straitened finances, he thought we should be careful in asking for another appropriation of such magnitude.

Mr. Thorne pointed out that while all would doubtless welcome the development of our engineering facilities, yet in the past there had been no necessity for such Government fostering as this bill proposed. That fostering had been provided for in the last half century by our patent laws. These patent laws gave protection to the inventor and a stimulus to inventive genius which has hitherto been all that was necessary to produce in our country the most phenomenal expansion of inventive genius that has ever been known. In the case of agriculture there had been no such stimulus in the past. The benefactions to agriculture have been for the sake of furthering scientific research. The object of the experiment stations bill has been to provide leisure and opportunity for abstract research, which was not provided for in any other way. Therefore, while we all must welcome all possible development of engineering science, it did not seem to him that such a measure as that proposed was at all necessary to further that development.

Mr. Harris called attention to the fact that the Association was not an association of individuals, but of institutions, and was made up of a certain number of colleges which, by the very law of their foundation (first passed by the influence of the agricultural interests), made mechanic arts an equal interest with agriculture. It was also made up of experiment stations, which are departments in these institutions. It seemed to him that the Association represented the mechanic arts as fully and legally as it represented agriculture, and should, if the case seemed to demand it, recommend to the National Government an appropriation for investigation in the sciences which underlie the engineering professions. He did not agree with the last speaker's statement that the mechanic arts had been sufficiently cared for by the patent laws, and as to the wisdom or unwisdom of asking for an appropriation in the present financial straits of the Government, he pointed out that the bill does not take effect immediately.

A division being called for, 18 votes were recorded in favor of the motion and 11 against it. Adopted.

The report of the nominating committee was then presented, and upon motion adopted as follows:

REPORT OF COMMITTEE ON NOMINATIONS.

Your committee appointed to nominate candidates for officers of the Association beg leave to nominate the following gentlemen for the offices named:

For President.—H. C. White, of Georgia.

For Vice-Presidents.—(1) Alston Ellis, of Colorado; (2) W. M. Liggett, of Minnesota; (3) S. M. Emery, of Montana; (4) C. S. Plumb, of Indiana; (5) E. W. Hilgard, of California.

For Secretary and Treasurer.—E. B. Voorhees, of New Jersey.

For Executive Committee.—H. H. Goodell, of Massachusetts; Alexis Cope, of Ohio; J. H. Washburn, of Rhode Island, and R. H. Jesse, of Missouri.

For Bibliographer.—A. C. True, of Washington, D. C.

For Committee on Nomenclature.—H. P. Armsby, of Pennsylvania; C. M. Weed, of New Hampshire; E. H. Jenkins, of Connecticut; E. S. Goff, of Wisconsin; and *ex officio*, A. C. True, of Washington, D. C.

THOMAS F. HUNT, *Chairman.*

Confirmed.

Upon motion, the executive committee was directed to edit and publish the proceedings in connection with the Department of Agriculture.

Mr. Washburn, for the Section on College Work, stated that the officers recommended were: Chairman, A. Ellis, of Colorado; vice-chairman, J. L. Snyder, of Michigan, and secretary, E. A. Bryan, of Washington.

Confirmed.

The nominations for the Section on Agriculture and Chemistry were: Chairman, R. J. Redding, of Georgia; vice-chairman, C. D. Smith, of Michigan, and secretary, T. L. Haecker, of Minnesota.

Confirmed.

Mr. Corbett presented the following nominations for the Section on Horticulture and Botany: Chairman, S. T. Maynard, of Massachusetts, and secretary, H. L. Russell, of Wisconsin.

Confirmed.

Mr. Hopkins presented the nominations for the Section of Entomology as follows: Chairman, J. B. Smith, of New Jersey, and secretary, C. M. Weed, of New Hampshire.

Confirmed.

Mr. Murkland submitted the following nominations for the Section on Mechanic Arts: Chairman, W. S. Aldrich, of West Virginia; vice-chairman, A. J. Wiechardt, of Mississippi, and secretary, F. P. Anderson, of Kentucky.

Confirmed.

Mr. Washburn moved that the membership fee for each institution be the same as last year, viz, $10. Carried.

Mr. Corbett offered the following resolution adopted by the Section of Horticulture and Botany:

Resolved, That we urge upon the United States Department of Agriculture the importance of extending its collection of fruits and other economic plants by the addition of specimens showing foliage, flowers, or other parts, and of photographs showing typical trees or plants of all varieties offered for sale, in order to aid in the description of varieties and in the study of plant variation, as well as to discourage the duplication of names, and to secure due recognition to the originators of valuable varieties, and that there may be some one place where all varieties placed upon the market may be officially registered, numbered, and described.

Mr. Washburn moved that the hearty thanks of the Association be tendered the Commercial Club of Minneapolis for the courtesies extended. Carried.

Mr. True moved that the University of Minnesota be cordially thanked for courtesies extended. Adopted by a rising vote.

Mr. Smith, of Michigan, moved that one member of the executive committee be added to the committee appointed to consider and formulate a method by which our graduates may have access to the libraries, museums, etc., at Washington. Adopted.

J. H. Washburn, of Rhode Island, was appointed.

Upon motion, the convention adjourned sine die.

MINUTES OF THE SECTIONS.

SECTION ON COLLEGE WORK.

The Section on College Work met in room 16, Library Hall, University of Minnesota, July 13, at 4 p. m. In the absence of the secretary of the section, J. H. Washburn, of Rhode Island, was elected secretary.

The first topic for discussion was, "How may university extension work be best conducted by the colleges of agriculture?" and I. P. Roberts, of New York, read the first paper, as follows:

How may University Extension Work be Best Conducted by the Colleges of Agriculture.

For a long time thoughtful educators have agreed that no more courses of study should be introduced into the schools. Many are of the opinion that some should be stricken out, but it has not been made clear which particular studies, if any, can be omitted. All are agreed that the youths of the land should become interested in the growth and development of animals and other natural objects by which they are surrounded and with which they will have to do in after life, whatever vocation they follow.

Many attempts have been made to introduce the study of agriculture into the schools. So far as I know, all have failed. I suppose if a new study—say, for instance, "the universe"—was introduced it would fail in like manner, because of its very vastness. The term "university extension" is so expansive as to include not only agriculture and "the universe," but subjects outside of the universe which are learnedly treated by learned professors. Since a comprehensive name which may mean much or little must be used to designate the work, perhaps "university extension" will serve as well as any. University extension in the agricultural colleges should mean a study or investigation of a few natural things and natural laws—not all of them—in a natural way. What is the natural and logical way? The thing to be investigated and studied must be in the hands of the teacher and pupil. The effect of a law must be graphically illustrated, and abstract teaching, which to the youthful mind is as dry and windy as a simoon, must be abandoned in the schools. The good Quakers, who had not the heart to kill even a vicious cur, easily secured his taking off by renaming him "mad dog."

I wonder if we can the better accomplish what we all so much desire—a better and more natural course of studies in the school—by renaming the university extension work "nature study." The majority of farmers are anxious to secure a better and more extended understanding of their profession. They are difficult to reach because they had no training in their special calling, and not because they are unwilling to learn.

The provisions for training and educating the farmers' children are most lamentable, considering the age in which they live and the problems which they will have to solve or remain underlings, "hewers of wood and drawers of water," all their lives. It is humiliating to look over the courses of study offered to farmers' children and see what scant provision has been made for teaching anything which has direct relation to tilling the soil, or for giving any inspiration, or for developing any natural power which might help them to discover the laws which govern the soil, plant, and animal life, or the still more complex laws which dominate their welfare and even existence.

Only two-fifths of 1 per cent of the pupils in New York reach the colleges, and fully 20 per cent of these fail for one cause or another to graduate. What a small fraction of the total population is making any effort to secure what, for a more appropriate

name, is called "a liberal education!" What vast expenditures are incurred each year for the liberal education of a few persons, few of whom ever rise to the position of leaders!

I doubt if any student ever received a liberal education at any university or college. They sometimes become slightly familiar with a few double-edged tools, which soon become dull and rusty if not used, and if used are quite likely to wound the user until skill is acquired in handling them. A liberal education can only be secured through honest battling with many problems of life. Only a small percentage of the children of the nation remain long enough in the public schools to graduate from them. The graduates of the schools and the colleges form so small a percentage of the youths of the land that all their efforts fail to materially advance the average intelligence of the people. We spend fabulous sums for education each year, which prevent, it is hoped, the general intelligence from retrograding.

To me the results of the expensive and stupendous efforts to advance intelligence, to promote comfort and happiness, to develop a taste for the beautiful among the masses, and to build a firm and enduring foundation for law, order, and virtue are far from satisfactory.

Large numbers of able distinguished educators and philanthropists have been earnestly working to improve our educational methods in America for more than a century. With voice and pen they have striven to lift our people from the half-civilized to the civilized standard. True, we have largely outgrown dog fights and bull and bear baiting; but can a people be said to be civilized a majority of whom still take supreme delight in cock fights, slugging matches, football games, and lynching escapades?

All agree that we have not reached perfection in educational methods, but can I, a plain, unknown man, add any suggestions which may be helpful? Can the agricultural colleges, which have broken loose from many of the traditional methods of training, do anything to put new life into the schools and destroy the bastiles which are now being erected for the confinement of truant children? All young life inherits a love for investigation, for knowledge. In less than a year from the time a child begins to walk it becomes thoroughly familiar with all the objects of its new world, has investigated in detail every article which it can reach or handle, and by the end of its fifth year it will have a good use of knives, scissors, hammers, and hatchets, and will have located the sugar barrel and preserve jar. All these things have freshness, minister to pleasure, and have been the means by which the child has acquired valuable facts, a world of useful and pleasurable knowledge. Why not, then, go on and educate the child in the natural way? Why at the age of 6 or 7 metaphorically bandage and dwarf its understanding by artificial methods which cripple the child more fatally and which arrest the natural development of the mental powers more certainly than do the bandages dwarf and cripple literally the feet of celestial children?

I believe the colleges of agriculture, now in their youthful vigor, may do much to change our methods of education from a too artificial to a more natural basis. At Cornell University a most vigorous effort has been made during the last year by the college of agriculture to introduce nature studies into the schools of the State. Seven leaflets and a few bulletins, written with a view of giving collateral assistance in the work, have been published. One of these leaflets, "A children's garden," which has gone to a fifth edition, is designed especially for the pupils, the others for the teachers. All of the teachers' leaflets except the last one have gone to a second or third edition. Four teachers have been regularly employed to introduce this work into the schools above the primary grades.

Our first object in issuing leaflets on nature studies was to develop in the pupils the power of accurate observation, to promote investigation, to arouse enthusiasm, open the eyes of the pupils and parents in order that the future tillers of the soil may become better acquainted with nature's laws or modes of action, thereby enabling them to direct the forces of nature's laws so intelligently as to produce the highest results.

It is difficult to adequately set forth the enthusiasm which has been manifested by teachers, pupils, and parents in our work. Several thousand teachers have become interested in the work and more than twenty thousand pupils have been reached during the last three months. The aim has been to reach the teachers and parents through the pupils. Manifestly we can not hope to reach all the pupils; hence the work has largely been to furnish text and methods for the teachers, and in the future will be mainly in this direction.

Thousands of pupils have been led to raise plants and to study many natural objects while securing many valuable facts through their teachers. This work does not presuppose that a regular lesson is to be crowded in or that an additional set lesson is to be learned. The work occupies but a few minutes each day and serves as a rest exercise, which is followed by no dreaded formal examination. Many children have no plat of ground upon which to grow plants. In such cases teachers

have induced the pupils to bring cigar boxes filled with earth to the schoolroom, and the most surprising exhibition of our work which we have seen was a great city school filled with hundreds of healthy flower gardens, 4 by 8 inches in size, revealing a new world to the most happy and enthusiastic children ever seen in an American schoolroom. This enthusiasm of the children has reached the parents, and sixteen hundred farmers are registered in our university extension work.

A circular containing a dozen questions and suggestions is sent out, and when the replies are received a second circular is sent out which aims to solve doubts and difficulties and to give useful information. By these means we have been able to arouse and sustain interest and to secure the cooperation of more than five hundred farmers in experiments now being carried on throughout the State in culture and fertilizer tests with sugar beets and various other crops. The dairy interests have not been neglected. Two instructors, aided by several assistants from time to time, as exigencies require, have devoted their time to giving instruction and help to the dairymen. If a disease of plants or animals or a depredation of insects threatens to become serious in any locality, a trained expert is immediately sent out to give all assistance possible and to investigate the cause of the trouble. All of this work may not inaptly be called "agricultural extension work." I do not know that we shall be able to till thoroughly and successfully the entire field of present operation. I can only say that no work which we have yet undertaken gives promise of such far-reaching and valuable results.

In discussing this paper, Mr. Roberts said that in conducting this new work it was soon found that what was needed was a school, not a farmers' institute. He spoke of the lack of suitable text-books and described the leaflets which were issued to meet this need, including Professor Bailey's leaflet on "The children's garden." The object was to furnish material to the teachers of New York and give them some instruction in methods of presenting the subjects. Thousands of teachers had been reached and the leaflets could hardly be printed and dispatched as fast as they were called for. The results of the work had been far beyond expectation and they were in some danger of being swamped by it, although the appropriation was a liberal one.

The same subject was discussed by A. W. Harris, of Maine.

B. C. Buffum, of Wyoming, discussing the subject, said:

We have a university extension course established in connection with the University of Wyoming, and a large part of my work on this course has been correspondence work. It is along the line of Chautauqua work; that is, we outline the text-books to be read. By correspondence we answer any questions for the student; if the farmer or his sons and daughters get into difficulty at any point, we try to help them out by correspondence. This takes a good deal of work. Fortunately we have not had very many to take this course; if we had, it would be necessary to have circulars for answering general questions. The lecture courses we have offered have been given in several towns by the people merely paying the expenses of the lecturer while away from the institution. At the end of each course the student is given a certificate. For instance, if I give a course in agriculture by correspondence and a student has finished a certain course of reading, he is given a certificate which will allow him to omit that line of work if he ever comes to the university.

J. A. Myers, of West Virginia, who was to have presented the third paper, begged to be excused, since circumstances had prevented him from finding time to prepare it.

J. L. Snyder, of Michigan, who was to present the fourth paper, said:

I have been much pleased with the discussion so far, and especially with the plans presented by Professor Roberts. I have been watching the New York plan for some time, and think it has much merit. In this university extension work I think we must get hold of the children. Farmers' institutes are all right, but we shall not do much by institute work alone. We make a considerable sacrifice in our State in order to send our best men to institutes, and I think the work is appreciated. In addition to these general institutes, we hold a number of one-day institutes. Of course where there is only one institute held in a county it is usually at the county seat or some large town, and the back districts are not reached in that way. So last year we inaugurated one-day institutes. We send a good man into the county, and he goes clear back into the outer districts and gathers the people into a schoolhouse for a one-day institute. After the one-day institutes are held, we hold a round-up meeting, lasting two days. We intend to hold many more of these one-day meetings next year. We think we shall reach in that way a class we could not reach in any other. We have held women's meetings. In nearly all our farmers' institutes we have held a woman's section, and our professor of domestic science has gone out

and created considerable interest. This year in our fruit districts we are sending out instructors to hold what may be called summer schools. A man goes to a district, holds meetings every day for a week, and then takes the class into the orchard. We have also had for several years what we call the farm-home reading circle. Several hundred, perhaps five or six hundred, of the young people of the State have joined this organization. It is carried on on Chautauqua lines exactly. Last year we induced our legislature to pass a law directing our superintendent of public instruction to prepare a course of study for district schools, known as the agricultural college course. We hope to have a course of study for them which will give considerable agriculture—considerable of the work indicated by Director Roberts. Now this is new, and we expect to have considerable difficulty before we reap much benefit from it, but we do feel that our courses of study as now pursued lead pupils away from the farm. They are not in practical touch, as they ought to be, with farm life. In many schools they begin in the first grades with Greek, mathematics, Roman history, and so on, tending to lead directly away from industrial pursuits and away from farm life. Our high schools are organized to suit the university, and our country boys and girls are gathered into these high schools, and instead of being fitted to go on the farm are led away from the farm.

We have started to prepare bulletins for the different schools and as we have not had much experience in such lines I can not give the results of the work, but we are in full sympathy with the work as indicated by Director Roberts. While people have talked a good deal about nature study and it has been introduced into a great many schools, there has not been the material such as the New York Station is now preparing. I am very glad that at least one station or college is making an effort in this line, and I feel a great deal of confidence in the outcome.

Mr. Canfield. There are one or two points which I think we are in danger of overlooking, and I want to speak briefly on them.

We are in danger of overlooking one great force (now a well-organized force) in the Western and Middle States, and possibly also in the Eastern States, especially that form of the force which has brought itself into the federated condition and is now systematically at work. I refer to the clubs known as women's clubs. They are a great and increasing power. Their work is being done more and more systematically and thoroughly from year to year. Their programmes are worked out very carefully, they are more carefully prepared from year to year, and they cover a greater variety of subjects. These clubs are being extended from the towns and cities where they began their work, into the rural districts, and they are proving very powerful factors in the betterment of these districts. Farmers' wives and daughters, who have not had any inducement to go beyond their district school, are finding new life in all this and are gaining in general intelligence and fitness for their work every day. We ought to make use wisely of these clubs, which have been wise and strong enough to federate themselves. There are a few clubs, of course, that are being maintained for the club's sake, but the great mass of them are attempting to do something besides this, and I think we ought not to overlook them. It is a very easy matter to secure their formation. There is no expense to anyone. Meeting once a week, or once in two weeks, it stimulates neighborhood feeling and the social side is not lost sight of. Through these clubs we could certainly, if we choose, secure a great deal of attention to the subjects in which we are directly interested, and which would be of benefit in their respective communities.

The other matter, which I fear we are in danger of overlooking, is that life is limited and that there is such a thing as time. I think we are undertaking a great deal too much in a great many different ways. It seems to me that we are constantly in danger of dissipating our energies and neglecting the specific work given us to do. It might be well for some of us to be strong enough, when we are asked, Why did you not send out your professor of agriculture to do thus and so? to say frankly, he has all he can do at home. Until means are forthcoming and the time can be given to it, so that it may be done without neglecting the work with which we are specifically charged by our grants and appropriations, I think we ought to be very careful and possibly tend a little more in the direction of withholding rather than giving. Yet I would give the last day, the last moment, of time that can be given without allowing the work to suffer.

I think also we are in some danger of fancying we can do everything in a moment. It takes a long time to educate a whole people, and I think we ought to understand that and be very patient. We are in danger of undertaking so many things that we do not do them well, and it seems to me better to do a few things thoroughly well than many things carelessly. There is an old New England phrase I recall which I think is most expressive. They speak occasionally of things that "frazzle out;" I think we are undertaking a great many things, and are in some danger of letting some of them "frazzle out." We ought to be particularly careful that our educational work is well and properly done as well as attempted. I believe the general

educational effect is worse when you undertake and abandon a given line of work than when you do not undertake it at all.

At the evening session the topic for discussion was "Preparatory work in colleges of agriculture."

R. H. Jesse, of Missouri, spoke as follows:

I must present what I have to say in the somewhat fragmentary form which frequently characterizes discussions; but I should not have accepted a place on this programme had I not had on this subject very decided convictions.

The question is, Is it legal and is it proper for colleges of agriculture and mechanic arts to maintain preparatory courses? I hold, first, that the legality is exceedingly questionable. Colleges of agriculture and mechanic arts must conform, it seems to me, in theory at least, to the standards which are established for colleges in general. It is perfectly idle to juggle with the fact that they are colleges of agriculture and mechanic arts, and that the word college must be interpreted for us as it is for other institutions of learning. Therefore, when the Federal Government makes an appropriation for the maintenance of a college of agriculture and mechanic arts, I hold that the Government understands a college to be a college. The question would therefore arise whether the maintenance is consonant or not with the idea of a college. Senator Morrill is often quoted in this matter. I have been told that he did not understand that a college was necessarily a college (I am going by hearsay), but thought that preparatory work might with much propriety be included. I yield to no man in my disposition to do reverence to Senator Morrill, and I would abstain from saying anything on any occasion that would savor of disrespect, but this question is not to be determined by what any man had in his mind when this bill was drawn. When the bill was finally drawn it said "College of agriculture and mechanic arts," and the language used in the bill must be interpreted by the laws that govern the interpretation of language and not by what any particular man had in his head. It seems to me if the Government gives money for the maintenance of a college, it is questionable whether it is legal to use that money for the maintenance of work which is not of college grade.

But it seems to me we do not have to confine our attention to the legality of the question. Let us grant, if you will, that it is legal; that nobody can or will check us in the maintenance of our preparatory departments. I am not sure that anybody could interfere with us; but let us waive that. I feel that we ought not to ask, "Have I a right to do this?" but rather, "Is it right for me to do it?" The question is, first, as to the legality, and, secondly, as to the propriety, of maintaining, in colleges of agriculture and mechanic arts, preparatory departments. I hold that the impropriety of maintaining these courses is unquestionable. The very notion of a college is against it. It is idle, so far as I am concerned, to point me to the fact that perhaps more than half of the colleges in the United States do maintain preparatory departments. In fact there is not an institution of higher learning on the soil of Missouri, except the State University, that does not maintain a preparatory department. Every college, even those that support preparatory departments, will admit that the preparatory department is not college work; that it is an incubus, a sort of mild curse. They plead that they do not know how to get along without it. It does not seem to me that it is necessary to support preparatory courses in colleges of agriculture and mechanic arts, except as a temporary measure; and lest I forget it, let me deal honestly with you here and say that in the University of the State of Missouri, while we have abolished the preparatory department, the college of agriculture and mechanic arts is not based on the district schools, so we had to put two years' preparatory work in our own college. Therefore, what I am condemning is found in the University of the State of Missouri, and I wish to put that institution along with the colleges in which I condemn preparatory work. It seems to me that the proper place for this preparatory work is in the public schools, and that if colleges of agriculture and mechanic arts would devote a portion of the time and money they now give to the maintenance of their preparatory departments to efforts leading to the introduction of agricultural and horticultural studies into the public schools, they would reach ultimately better results. My conviction on that point is profound.

I believe we should unite in efforts to introduce studies pertaining to agriculture, horticulture, and the mechanic arts in what are known in Missouri, at least, as the district schools. In fact, I can not resist the temptation to be revolutionary in this respect. I believe, for my own part, that the theory of education that is exemplified in our district schools throughout the country is fundamentally wrong. The notion underlying the district schools is, I think, that if you will make a man intelligent you will prepare him for good citizenship. It seems to me it is time now that that old idea should be got rid of. You do not prepare a man for good citizenship by merely making him intelligent. I confess you increase his chance for good citizenship, but I hold that intelligence alone is not enough for the schools to look for in the work of preparing men for citizenship. I believe that the cultivation of the

moral nature and of the industrial nature is of greater importance than the cultivation of the strictly intellectual. You can not cultivate the intellectual powers without training, to a certain extent, the moral; but I believe our schools are wrong in that they do not set as the chief aim the cultivation of the moral, social, and industrial faculties; not, of course, to the neglect of the intellectual faculties, but the State and the nation are more interested in the cultivation of the moral, social, and industrial powers than they are in the cultivation of the strictly intellectual powers.

I will call your attention now, if you will allow me, to a report which was presented at Milwaukee last week, called the report of the committee of twelve of the National Educational Association. It was a report made on rural schools, and in many respects I think it was one of the most remarkable educational documents that has ever been published in this country. I will not apologize for dwelling a little upon it, and advise every one of you to procure a copy and study it. You remember we had a committee of ten on secondary schools, after that a committee of fifteen on district schools, and now we have a committee of twelve on rural schools, and that committee has just filed its report at Milwaukee. The report has been published in pamphlet form, and can be had at 25 cents per copy from Hon. Henry Sabin, Des Moines, Iowa. The State University, feeling the necessity of introducing industrial studies in the district schools of Missouri, after much consultation and thought published in the spring a circular offering to the teachers of the State, free of all charge whatsoever, a summer course in shopwork, for we have good shops, and also a summer course in horticulture and entomology, for horticulture is the great industry of the State of Missouri. After that circular was issued and 15,000 copies scattered among the teachers of the State, I happened to meet, in St. Louis, Colonel Parker, of the Cook County Normal, and told him what we had begun to do in Missouri; how we intended to collect as many teachers as possible and give them, free of expense, thorough courses in manual training, drawing, horticulture, and entomology in courses of three to six weeks' long. The Colonel almost rose and hugged me. He told me of this report of the committee of twelve, and said that report was going to declare in favor of making farm life and home life the center of interest for the rural schools; that the report was going to set its face against this idea of taking the boy from the farm, keeping him for eight years in a school supported by the taxes of the agricultural people, teaching him how many rivers flow into the Arctic Ocean, but carefully avoiding all that had any connection with farm life; that the report declared in favor of building up a course of study for the rural schools around the farm as a center of interest. When I heard that, I came near hugging the Colonel. I got advance sheets of the report, and I feel sure that if you will procure it and read it through you will rejoice that such a document as that has been sent forth through the country by the authority of the National Educational Association. That authority comes as near to making it a part of our national educational policy as any action could. I hope myself to see the day when in Missouri every school will have a plat of ground by it for cultivation and experimentation; when the grounds will be laid out with excellent taste; when trees, vines, and shrubs will adorn the building and grounds inside and outside. The Germans, you know, have gone ahead of us in this direction. They not only have kindergartens, but school gardens. There is, I confess, no originality in the idea. We are merely following the lead of Germany in the hope that in the future every school will have by it a small plat as a school garden. I hope the day is coming when this will be an indispensable part of every school equipment.

In our own station work we are thinking out plans for the construction of schoolhouses whereby forcing beds and small greenhouses may be connected with even small schools at moderate expense. Missouri has certainly started out to do everything in its power, with the authority and weight of the State University and the college and station behind it, toward the introduction of the industries pertaining to the farm, garden, and shop into the district schools of Missouri. I believe they should not be introduced into the high schools alone; the numbers in the high schools are too few. The district schools are the places where we want to introduce them.

I feel that the cultivation of the industrial, moral, and social powers of children is the chief end to be attained in their education. I can not but feel, therefore, that if the agricultural colleges would set their faces against preparatory departments and in favor of this industrial training in schools, we should ultimately do better work. It is not possible in Missouri to cut off all preparatory work in the University of Missouri. We should exercise patience; we should continue our preparatory departments as long as they are indispensable; but I feel that the face of all these institutions should be turned against the preparatory departments. We should support them merely as temporary expedients, and I believe our energies should be directed toward the introduction of the industries of the farm, the dairy, and the shop into the district schools of our States. We should not rest contented, in my opinion, with the idea of maintaining a preparatory department. I know many of you differ

from me in this opinion, and of course you will not hesitate to express your opinions; but I, at least, must give account of the faith that is in me.

The address was discussed by President Canfield and others.

The following paper on this subject was received from Professor Hilgard, of California:

Preparatory Teaching in Agricultural Colleges.

In discussing the question of "The propriety and legality of including preparatory work in the instruction in the colleges of agriculture," it appears to me that it is first necessary to define what is meant by "preparatory work."

In so far as the first Morrill Act distinctly says that the instruction to be given in the colleges shall be in "the sciences bearing upon agriculture and the mechanic arts," it seems to me clear that no grade of instruction that does not include these sciences can legally be given in them. The kindergarten, the common, and the grammar school studies, as at present understood almost throughout the United States, can not find a place in them. The doubt only begins with the high-school grade, in which more or less of scientific study is very generally included, and will increasingly be so included as in the progress of time the commanding importance of scientific knowledge for the understanding of what have now become everyday appliances and household necessities, forces itself upon the attention of even the most conservative educators and advocates of the old régime. An additional force tending in this direction is the tendency of the universities to raise the grade of undergraduate admission, compelling high schools desiring to be accredited to include within their curriculum such subjects as elementary chemistry, physics, and botany.

The question confronting the agricultural colleges, then, is whether they shall aid in the struggle of the sciences for a place in preparatory instruction, or by including the elements of the sciences in their own curricula, bid for numbers rather than for a high grade of scientific and technical instruction, and shall to that extent weaken the other schools in the struggle for the rights of scientific teaching in the lower grades. Also, whether in so doing they are not violating at least the intention, if not the letter of the law, by scattering their means upon that which should properly be done in the other schools.

This raises the vexed and oft-discussed question whether the agricultural colleges should, or were designed to, educate the mass of farmers' sons, or whether, on the contrary, they were intended to educate, chiefly at least, the agricultural experts and leaders of progress. I think that the drift of the development of the colleges in the older States, as well as the consensus of opinion among the older members of this Association, points toward the latter view as the one that is ultimately to prevail. We have seen the colleges in many States coming in, in obedience to popular clamor, with low-grade courses of instruction and the enforcement of mere manual exercise as parts of the prescribed course. I was at one time myself connected with an institution pursuing this policy for a short period, short because the students soon left, they and their parents agreeing that it was not worth their while to stay away from their labor on the farm if they were to do very nearly the same things at the college farm. The same experience has been repeated over and over again in the popular colleges of the newer States, and at the meeting at Denver two years ago it appeared to me that manual labor had but very few defenders among those actually engaged in teaching. The same, I think, is coming to be the case with the low-grade courses of instruction. The demand for instruction of the university grade is becoming more and more urgent, even to the extent of a demand for the establishment of classical courses alongside of the technical ones. In other words, our agricultural colleges are slowly but surely developing into technical universities with courses prevalently for the education of the experts, teachers, and other leaders of progress who shall act as centers from which the advance of progressive agriculture is to radiate into the rural communities. In some other cases, on the contrary, the absence of other opportunities for secondary education threatens to reduce the agricultural colleges to mere local high schools.

It will be asked how, then, the benefits of agricultural science are to accrue to the bulk of the farming population and their sons? I reply that in this, as in other kinds of instruction, there is an absolute necessity for graded schools, and that there is no more reason why the bulk of the farming population should come to the agricultural colleges than why the mass of the rest of the population should come to the universities for their education, instead of going to the public schools.

Such graded agricultural schools are in actual existence in Europe. In France they form part of the common-school system, which, however, does not compel all pupils to be taught in precisely the same manner, the subjects being different for rural and urban communities. There is no sound reason why education should not

be adapted to the needs of the community in which it is bestowed. The customary uniformity of text-books throughout each State has thus far prevented this adaptation, very much on the same ground that it has prevented religious instruction. But surely the doctrine of equality, in its application to education to this extent, injures seriously the very classes it was specially designed to protect and benefit. It is an injury to them in preventing their being educated to the best advantage for their future pursuit. The city child needs for its future career a different kind of information from that which may be usefully imparted to the child in the country. Why, then, should both be compelled, on purely theoretical grounds, to undergo the same process of development?

It is often urged against the practicability of science teaching in the common and grammar schools that the children do not seem to profit by it; and this is, unfortunately, too true. But the fault does not lie in the impossibility of so teaching these subjects that they shall be both useful and interesting to the children, but rather in the failure in the teachers to properly appreciate the manner in which these subjects must be taught.

Text-book teaching is the bane of all instruction in science. Yet this, unfortunately, is all that most of our common and grammar school teachers that have been educated in the normal schools are able to do. With rare exceptions it is only the university-trained men and women who, knowing considerably more than they expect to teach, and emancipated from the text-book methods, are markedly successful as science teachers in the lower schools; and owing to the uncertainty of their tenure of office, it is not at all likely that the better preparation required for the purpose in question will be very generally obtained by them within any short period of time.

Those of us who attend teachers' institutes can not but have been struck with the large prevalence of special prescriptions and patent devices for instilling into the child's brain, in the shortest possible time and with the least trouble to the teacher, certain subjects or branches of the course, resulting but too commonly in mere mechanical memorizing, without any proper understanding on the part of the pupil, who will frequently in after life, when confronted with the actual application of the subject supposed to have been learned, find with surprise in some recess of his memory words or rules heretofore meaningless, but now assuming their proper place in his store of knowledge. Such teaching as this, and, worse than all, the teaching of some branches such as grammar, the metaphysics of language, long before the child's mind is qualified to take in and utilize, but merely to memorize it, involves an enormous waste of precious time, compared with which that which would be necessary for instruction in the rudiments of natural sciences would be but a small fraction. It is, of course, idle to hope that this perfunctory method of teaching, and the qualifications of the teachers, will be rectified within any short space of time. We must, therefore, look in another direction to obtain the much-desired elementary instruction in natural science in the lower schools.

In so far as the common and grammar schools are concerned, I think the end can be attained by the appointment of thoroughly competent teachers, who shall, instead of being attached to any one school, be a kind of circuit riders, so to speak. For instance, each one shall visit the common schools as well as the grammar schools in one county from time to time during the year, giving in each a short course of any such branch of natural science as may be most readily available in the locality. Such courses would serve as an example and incitement to study, both for the teachers and the pupils, not merely as regards the subject-matter, but to the teachers specially with reference to the methods of presentation. The expense of the employment of such comparatively high-priced competent men would thus be sufficiently distributed to render it available to the schools of a considerable region, and would serve to promote greatly the interest of the pupils in the country in farm and farm work. In the course of time it would do away entirely with the kind of instruction which all of those who have taught the sciences have learned to reprobate in the "fourteen weeks' courses," which two decades ago were supposed to be the very perfection of instruction in the natural sciences, but have, on the contrary, proved an obstacle to their introduction into the lower schools because of their recognized utter uselessness, apart from the fact that, being written by persons ill qualified as specialists, they contain a great deal of matter either irrelevant or absolutely incorrect.

It seems to me that it is in this way that we can approach most successfully the solution of the problem of such preliminary instruction in natural sciences as will enable the agricultural colleges to do the proper kind of science teaching intended by the Morrill Act. All probably agree that preparatory education outside of the sciences bearing upon agriculture and the mechanic arts should not be given in the agricultural college. It is only the lack of proper preparation in the sciences that has at all raised the question that forms the subject of this paper.

A. Ellis, of Colorado, spoke as follows:

Metes and bounds have not been put to the work of the land-grant college, and I am glad of it. I am glad that the institution has not a history to which it can refer. I like to think that things are, to a certain extent, in a tentative condition, and that there is the opportunity—possibly of a lifetime—on the part of educators to differentiate the higher education as it is found in these land-grant institutions from the higher education that has been in vogue during all our educational experience. I suppose it will be almost impossible to discuss this subject without giving it some local coloring. Is it possible for us to reach grand, broad generalizations and ground upon which all can stand to enunciate principles that will be of universal application? I had the pleasure of listening to the discussions in the Section on Agriculture this afternoon, and it was there specifically stated that plans and principles which would be effective in Massachusetts might fail utterly in Minnesota. We know that conditions will necessarily call upon us to change our methods, and the conditions that surround the institution in my State may be conditions that call for a certain organization of the teaching force which would not be feasible under different conditions.

Now, in regard to the preparatory school or course in the land-grant college I can see nothing legal in the way of the establishment of that course. Simply to say that the word college means college and nothing else, does not carry with it any argument against the establishment of a preparatory course in connection with the land-grant college, for the reason that we do not receive our whole financial support from the United States Government. This support is received under State laws as well, and we may be compelled in our organization of the land-grant college, supported as it is in part by the bounty of the General Government, to conform to the laws and statutes of our own State, under which the college is founded. Now, circumstances will have almost wholly to settle this matter for us. I think it can be admitted in theory that it would be advisable not to have the preparatory school; that our energies should be devoted to the prosecution of the legitimate college work, without the interference with the time of the instructors necessary for carrying on the preparatory courses; but if circumstances arise, or if our statutes seem to require the formation of these preparatory schools, there is certainly nothing legal in the way of their establishment and support. Then the question comes up as to the propriety or expediency of the establishment of such a course. I believe that under normal conditions as they ought to exist it would be possible for the agricultural college to do as many universities have done—discard the preparatory course wholly and give their whole attention to the college work; but in the majority of instances the college will be compelled to resort to a preparatory course in order to bring its work into close juxtaposition with the work of the public-school system. I might say in this connection that I have passed twenty-five years of my life as a public-school man, and have seen almost every phase of education that these schools present, and I can say truly that in so far as my knowledge goes there are only exceptional cases where the public school makes any preparation whatever for pupils to enter the classes of the agricultural colleges; also, that the courses do nothing whatever to direct the attention of students to industrial education. It is true that the school courses are largely directed by university men. As a matter of course, the scheme of instruction that will be prepared by these men will be a scheme that will further the education in which they have the most interest and with which they are best acquainted.

Pardon me for an allusion to our own State, where we have a course of instruction prepared by a committee appointed by the State Teachers' Association. This committee is made up of four members, three of them presidents of universities, and the fourth the principal of the Denver High School, a renowned and honored graduate of old Harvard. You may imagine the circumstances we are laboring under in Colorado when we depend upon the public schools to furnish us a product that we can work into the regular college department. We are absolutely compelled to have a preparatory course. There is no articulation whatever between the work of the public school and the work of the agricultural and mechanical college. When the State comes in and peremptorily directs that we shall receive students of a specified age, and having attained a certain standard in the public schools, and that age and standard do not comport with the dignity and work of the college, we are absolutely compelled to establish a preparatory school, whereby we may be able to produce a product qualified to take up the regular college work. Now, I believe the time will come when a great part of this difficulty will be eliminated, and I hear with satisfaction that we have a committee of the National Educational Association that has formulated a course of study that will meet these requirements; but I sincerely hope that that committee is not composed wholly of university men who never had a practical handshaking acquaintance with a private or public school of the character of our district schools in their lives. That is the reason we have so much theory in our courses of instruction. Now, if we could have a fair share of the teachers' and

pupils' time devoted to those subjects which adequately prepare for the work we have in the agricultural college, the necessity for a preparatory course in connection with such a college would not be apparent. We may look forward to the time when we may dispense with the preparatory school, for the reason that the public school will do the work and do it adequately. But until that time comes (and I am afraid I am not enough of an optimist to see it in the very near future) it will be absolutely essential that we should continue our preparatory courses, and there is nothing legal in the way; it is simply a matter of propriety, or rather of expediency.

I think there are means and instrumentalities by which we can obviate this difficulty, which I have attempted to present to the section this afternoon, but that difficulty will not be met nor overcome by simply preparing a course of study and getting a few appliances to place in the schoolrooms of the land. Until we can get teachers qualified to carry them out such courses of study will amount to nothing. And that brings up the question, How shall we prepare a teaching body to carry out such industrial training? Not one thing the teacher learns in the normal school trains him for industrial teaching. We must have teachers prepared to take up this work, and the public school must be the instrumentality whereby we will have pupils prepared to become students of the agricultural colleges, and until that time comes we may theorize as we will, but the preparatory course is a necessity, and we must have it. It is needless to say that we have our high schools over the country. I wish I had language to measure the contempt I have for the scientific work that is done in the district schools—a little instruction in alcoholics and narcotics, and a little smattering in elementary botany by a young slip of a girl that has not yet passed the rudiments of scientific instruction. Talk about preparing pupils for the agricultural college under such instruction as that—it is simply nonsense. We want to have our course reconstructed; we want to have our teachers feel that the great industrial element in this country is deserving of some consideration at their hands, and that the old-fashioned idea of education—that it begins in the kindergarten and ends in the university—will, in this enlightened time, have to suffer some modification. There is a place in this great system of education for the agricultural college, the industrial school, and the technical school, and we must force parents and teachers, by an enlightened public sentiment, to feel that this want must be met; that it is a want which the industrial people have a right to present and have respected.

I venture the assertion, as a public-school man, that a large part of the work done in the public schools, and particularly in the high schools, results in imbuing the child with the idea that good, honest, hard, persistent work, that smacks of manual labor and toil, is something to be shunned, and the only way to shun it is to get this higher education; drift through public school, high school, and university, and you have rounded out the whole arc of life.

I wish we had not the preparatory school; it is no more needed under normal and sensible conditions than a wagon needs a fifth wheel.

Mr. JESSE. I should like to enforce a remark made by President Ellis to bring out one other thought which I failed to emphasize in my hasty talk. It stands to reason that if agricultural studies and horticultural studies and manual-training studies are to be introduced into the schools at all they must be introduced primarily through the training of teachers. That goes without saying. In my statement to you regarding the University of Missouri, I called your attention to the fact that the first step we took was to open a summer school for teachers. The agricultural colleges must take on a phase of normal work. I want to leave that thought with you. The farmers are inclined to keep to themselves and not cooperate with any other class. The agricultural colleges are inclined to keep to themselves and not cooperate with any other colleges. It is a profound mistake. It would be infinitely better for us if we mingled more with the teachers of the State. Is it not better for us to work as rapidly as possible toward the day when the other schools of the State will be preparing for us, and is it not better for us to be in closer sympathy with the public-school system of our State? I do not find that the agricultural colleges do it, but the universities do. Is it not true that the universities sympathize more and work more with the schools? Is not the remedy for the agricultural colleges to try to work in harmony with the established educational systems of the State?

Mr. CONNELL. In my experience in three Southern States I have been deeply impressed with the truth of statements made by the presidents from Colorado and Missouri with regard to the trend of common-school teaching against industrial training. No one in the agricultural colleges has so much right to complain of the

tendency of teaching to turn students away from industrialism as the teacher of agriculture. In spite of enthusiasm, the dead weight that must be lifted in overcoming this trend away from industrialism is sufficient to neutralize 75 per cent of his best efforts. We have all agreed that the results acquired in agricultural-college teaching have not been altogether satisfactory. This discussion has presented this question to me, How much of this failure is due to education away from industrialism, rather than failure upon the part of the agricultural college in its equipment and professors? There is no one so well placed to appreciate the difficulties of the situation as the man who attempts to teach agriculture from the scientific standpoint. How to get hold of raw material that is teachable is one of the hardest problems we have to solve. I find men in my classes absolutely ironclad against any instruction I have for them, although they take the course voluntarily. I throw this out as a suggestion that may possibly explain something of our failure.

In the line of ways and means to prevent some of the difficulties under which we are laboring, we need to get this raw material into shape through the teachers of the State, but can we not draw the teachers more closely to us, not only by giving normal instruction in manual arts and horticulture, but would not some of our college buildings afford excellent accommodations for summer normals held along these lines, and in this way introduce to teachers the plans and methods of the agricultural colleges?

The following paper was read by W. M. Hays, of Minnesota:

Preparatory Work in Agricultural Colleges.

To study the propriety and legality of including preparatory work in the instruction of land-grant agricultural colleges, we must first recognize that different conditions are found in each State. Some of these differences exist temporarily, because of the undeveloped condition of agriculture in the State, or of the public schools, or of the college itself.

In new States the farmers are bent on establishing themselves on the cheap, fertile lands, and their fortunes have not reached a point where they are investing much in higher education. Some States have excellent preparatory schools, but in most States the farm boys and girls reach the college student age without sufficient education to enter a college course of standard grade. This is especially true in poorly developed farming communities, as in the West and South, and even in some Eastern districts where agriculture has retrograded.

City high schools are having a most important influence in this matter of preparatory courses. In the newer States the old-time academies and the small would-be colleges have had comparatively little development. In the older States the academies are actually giving away to high schools. High schools are rapidly setting up standards of graduation, which naturally form the standards of entrance into colleges and universities. The movement to have all first-class colleges and universities adopt a high, uniform standard of entrance requirements seems natural and irresistible. Agricultural and engineering four-year courses are being placed on the same high basis of entrance requirements as are the other courses of universities and colleges. If colleges are to be divided into first and second class institutions, will our agricultural colleges wish to be placed in the second class?

So far the most prominent function of agricultural colleges has been to educate professional agriculturists for experimenters and teachers. The interests of this class of work demand that the college course be most thorough. Students who attend these colleges for the excellent scientific course will also want higher qualifications. Placing the requirements up with other first-class college courses puts the agricultural college course out of the reach of the average farm boy or girl, who will or should remain on the farm, and yet should have an agricultural education. And the tendency from within to raise the requirements will be met by demands from the farmers to leave the requirements easy unless some method is adopted that will better meet the needs of those farm boys and girls who are to continue farming and need some special training for their life work.

Every agricultural college has some things peculiarly its own to consider in bridging over the gap between the country school and the college course. Some colleges try to do this by a combination of low requirements and a poor secondary school called a preparatory course. Some have felt proud when they could retain the number of their student body at one or a few hundred and with rather low requirements avoid the preparatory course. A few colleges have been open to the charge of conducting high schools for the town near which they are located, or schools of book-

keeping and business practice for the general community. Others seem to get along by denominating those unable to pass entrance examinations as "special students," allowing them to elect their studies from the college course schedule.

Our colleges have been receiving young people who look to the college with more or less desire to enter professions, and, after increasing that desire, the college graduates them better fitted to do well in the professions than as farmers. This may be a commendable work, but after the agricultural colleges have taught classical institutions how to give a more concrete and practical education than was in vogue when land-grant colleges were started it may be wise to branch off entirely in their own special field, where there are fewer laborers in proportion to the work needed to be done than in general college education.

Besides these young men and women who have entered college for a means to get into town or city life, there has been another class a hundred times too small in number. This class of students not only comes from the farm, but wishes to remain, and should remain, in that business. Occasionally one of these students takes the entire collegiate course; others elect the practical studies; yet others remaining for a short time take preparatory studies or the first portion of the regular course, and return to the farm with the name of having been in the agricultural college, but having received little or none of its agricultural training. Other colleges outline for these students, and for those who wish only a short, practical education, a course of one or more years largely made up of the more technical studies of the four-year course. Others have offered to the farm boys a lecture course of a few months, really an extended farmers' institute. Others are trying to take agricultural education to the farmers by means of university extension. Minnesota has become wedded to her plan of secondary agricultural school of nearly a high-school grade. This school serves primarily as a practical trade school for young men who are entering the business of farming, and secondarily it serves as a preparatory or secondary school under the agricultural-college course. The mechanical and other land-grant college engineering courses require graduation in some accredited high school or its equivalent, the same as with the general scientific and literary courses of the university. Graduates of accredited high schools are admitted into the college course in agriculture after taking, in addition, the school of agriculture course.

In former discussions in this Association some have held that the land-grant fund of 1862 and the Morrill fund of 1890 may be legally used only for instruction in college courses. Should this view strictly prevail, not only courses which give preparatory work in academic studies, but short lecture courses, agricultural schools, dairy schools, and other special courses would need to be supported by separate funds provided by the State. All will agree that the main proposition is right and that conducting classes in arithmetic, reading, writing, and other studies of preparatory grade was not contemplated in the enactment of national laws appropriating money for agricultural colleges, and as soon as possible the State and communities should be compelled to pay for all instruction of this grade.

The committee of this Association on courses of study is working out a definition of what properly constitutes a college course. This necessarily brings up the question of uniform entrance requirements, and we very properly shall face the question of whether funds accruing from Government appropriations shall be used exclusively for college courses and post-graduate instruction. Shall we not use some of the college funds to help organize secondary and special schools and to further demonstrate their value? The two most serious disappointments the farmers have felt over the system of American land-grant colleges has been the small number of students studying agriculture and the small proportion of graduates who have returned to become model farmers.

Preparatory courses have seemed a necessary makeshift in many of our agricultural colleges. A different type of secondary or preparatory course may best solve the problem. Land-grant colleges may soon feel impelled to divide their agricultural work into two courses—an agricultural high-school course for the many who wish to farm, followed by a college course for the few who wish to teach and experiment. College thought seems ready to demand this in the interests of higher uniform collegiate work. Rural thought is, in certain sections, at least, crystallizing around the idea that we must have agricultural high schools to prepare for farm life. We are behind the Old World in this form of education.

The time seems ripe for magnificent work of this character to spring up in every State. The only serious drawback is that the expense is considerable and the necessary plant and equipment are large. Practical schools of agriculture are more easily made successful on a large, well-equipped college and station farm than on new and separate farms. Branch agricultural schools in each State would not seem wise until there is far more development than now.

Of our rural and village population of 36,000,000 persons, probably 6 per cent are farm boys of the ages of 16 to 21, inclusive, and a like number are farm girls. If we could give to one-twentieth of these, or 110,000 boys and 110,000 girls, an agricul-

tural high-school course, farm practice, the cooperation of farming interests, farm living, and substantial prosperity would be made more perfect. If only the usual small percentage of these students abandoned agriculture and a small percentage went forward with college education to become professionals in agriculture, we would soon have a large number of farmers with technical school training. What would better tend to build up farm practice, farm thought, farm prosperity, and farm living, and preserve and broaden the foundation of the national life?

A third of a century ago the ambition of our people was to offer to all youth free common-school education. Our cities and towns have since actually risen to the point of offering free to all young men and young women who can spend the necessary time free secondary or high-school education, and the universities are now making the academic college free and the professional college very cheap.

For purposes of practical illustration of the advantages of changing preparatory courses into secondary schools of agriculture, I take the liberty of discussing the situation in three States with which I am familiar.

In a State like North Dakota the college has alternatives in reference to entrance requirements, as the competition for students with other institutions is awake, even in a new State.

First. Entrance requirements may be placed low, requiring the college to rank only with other new collegiate institutions of the State.

Second. Requirements to the freshman year may be higher with a preparatory course made up of common and high-school studies.

Third. Requirements to the freshman year may be even higher, high enough to give the college course rank with first-class colleges in older States. With the common and high-school studies of a preparatory course may be placed numerous agricultural and scientific branches making a secondary school of high-school grade.

The difficulty in the problem in this new State, not yet able to add largely to the college income, arises from the fact that more instruction and more instructors are needed to carry scientific and agricultural studies through two courses of six or seven years than through one course of four years. The State, however, would earlier see the advantage and would sooner feel able to add income to an institution which could attract large numbers of farm boys and girls into a short practical course.

Iowa represents a different condition. Her agriculture is well developed, some of her farmers have means for college education, her common schools are good, and her college is one of the older and stronger separate colleges. Iowa has usually had a subfreshman course with little or no agriculture in it. When the educators of the State wanted to classify the colleges of Iowa the question was raised at first as to whether Ames should go in the first class. By placing a part of the agricultural studies, now in the four-year course, with the subfreshman studies and making a two or three year secondary school, Ames could lower her entrance requirements so that the farm boy could easily get into the secondary school, and raise her freshman entrance requirements a year beyond its present point. Her requirements to the freshman class would then be equal to or above colleges which are jealous of an institution with free tuition. More teachers and more equipment would be required. But what State should be more free to appropriate funds for an agricultural high school than Iowa, with its rich agriculture, or than Illinois or Nebraska? It has often been said that Iowa farmers want their sons and daughters to have as good a college education as the people of other professions. This is true of those who wish their sons to become professional men and of a few wealthy families whose sons choose to remain in the farming business. And the college course in whole or in part should be open to every young man or young woman who wishes to remain on the farm. But there are many thousands who will not, can not, and should not spend the time and money to take a college course, yet who should take a short practical course in agriculture. Let a practical agricultural high school be widely advertised, and if southern Minnesota experience is repeated in Iowa, the school would become popular with the farmer and a great feeder to the agricultural-college course.

Minnesota represents a third type of States. The high schools here occupy nearly the entire field of secondary education, the State having been developed after the era of erecting academies had given way to the era of public high schools. The students from the high schools being accredited under rules by a State board to the university, gives to that institution a large number of students ready to enter the course with a high standard of admission. In the university the college course in agriculture would be discredited if its requirements also were not high. A preparatory course here would be impracticable, and even dangerous. It would be an easy way, a back door, through which the poorly equipped student would seek to enter the university. A collection of these poor students would discredit the agricultural course.

The necessity of a preparatory course in Minnesota has been avoided by means of the school of agriculture, which in some ways is an agricultural high school. It con-

tains the preparatory studies. Its entrance examinations are low enough to permit the student to enter from the country schools. Its academic and technical studies combined are sufficient to prepare the student for the college course with higher qualifications than is customary to require for entrance into agricultural colleges. This school course does not give quite the scholastic culture afforded by the high schools of the State. The lesser amount of scholastic culture, however, is largely made up by industrial culture, and the graduates of the school of agriculture who have taken the university course take a strong stand among their fellow-students. The agriculture and the general culture given in the secondary school places the four-year college course student a year or two farther along in general development than could be with even a short preparatory department.

It is the writer's belief that Congress meant that agricultural colleges should educate men for the business of farming and for the work of promoting farm science and good farm practice as teachers and experimenters. It seems less practical at the present time to try to accomplish these two objects by means of preparatory courses followed by college courses than to put a large part of the agricultural studies with the preparatory studies, making a secondary school. This plan does the opposite of cheapening education. It popularized practical education with the masses and it elevates the college course. Let us instruct our executive officers to secure action against States using national funds for common-school work, and at the same time let us encourage the nation and the several States to invest money in secondary and special agricultural schools.

SECTION ON AGRICULTURE AND CHEMISTRY.

The section was called to order at 2.30 p. m., Tuesday, July 13, 1897, by Chairman W. H. Jordan, of New York. The first paper was presented by I. P. Roberts, as follows:

Science Versus Art.

After having conned many definitions of "science" and "art" I am unable to draw any sharp line between them; in fact I am unable to draw any line. Webster defines science as "knowledge; penetrating and comprehensive information, skill, expertness, and the like." He defines art as "the employment of means to accomplish some desired end; the adaptation of things in the natural world to the uses of life; the application of knowledge or power to practical purposes," and then in the synopsis of the definition of art it is defined as "science." Who shall decide when doctors disagree?

How can it be said that science should be studied for science sake? Who is this personified deity before whom the savants are worshiping? Would we not better come to the conclusion that so-called science and art are or should be studied for the benefit, comfort, intellectual, and moral welfare of mankind? Why not meet the question fairly and admit that unless science, art, facts, dexterity, and understanding are taken out of the theoretical category and used for ameliorating the condition of mankind they are useless? The science of slugging, with many other so-called sciences, would better never have been discovered, since they have served to retard rather than advance civilization.

Most writers still endeavor to make a sharp distinction between science and art and a few investigators still claim to study science for science sake. I have known an able doctor to spend many long weary months to prove the existence of the metapore, a little hole in the brain, and to discover the astounding and useful fact that the metapore is also found in the brain of the ape; while thousands upon thousands of poor demented unfortunates languish and die in our asylums as the decades go by, little effort being made to discover the causes of and remedies for insanity. Had the same skill and patience been directed to the inspection of the brain and to a study of the inheritance and the history of these people who have been overtaken with a calamity worse than death, how much might have been accomplished to alleviate human suffering. Thousands of scientists studied electricity for a century for science sake, a few men studied it with the view of utilizing this subtle energy, and many burdens are lifted from the backs of over-toiling human beasts of burden.

The scientists, for science sake, gentlemen, toyed with sound waves from the fall of Jericho until the modern era. Edison, by one master stroke, utilized sound waves and the tired limbs of the messenger boy were relieved. True, the information acquired before Fulton, Morse, and Edison was of great assistance to them, but before them steam, electricity, and sound waves were investigated for their own sake, while these broader men, scientists if you please, studied these problems for humanity's sake and, incidentally, reaped a rich reward.

Having all these examples before us, the question arises, What direction should the efforts of the experimenters and teachers in the agricultural colleges and experiment stations take? First, problems which have direct economic bearing upon the welfare of our people should be selected. We should work for the people who support and maintain us. They have a legal and moral right to our services. If abstract or abstruse science is necessary to reach the highest results, then the more of them the better. If results can be reached more satisfactorily by inspection and comparison with little aid from science, then the more of applied experimentation the better. What I protest against is the tendency to belittle the results reached by art and laud those reached by science. The science of commercial fertilizers and their use have been studied most thoroughly, but little is the farmer helped in the art of using fertilizers. Thousands of soils have been analyzed, valuable information secured, but the art of selecting suitable seed, of tillage, of conservation and supply

of moisture to the plants are of so much more importance in almost every case, that the science of the soil sinks into insignificance when placed by the side of the art of tilling the soil. Science, so useful when not deified, too often follows on the heels of art and explains the facts already discovered. Those scientists who spend most of their time in their laboratories often fail to appreciate the labors of the workers at the other end of the problem.

You may not have heard as often as I have the expression, "Oh, he is not a scientist." This paper has been written for the purpose of helping to bridge the chasm which too often exists between the practical man, the farmer, and the scientist. This gap has arrested and is arresting the progress of agricultural education and the adoption of improved methods throughout the country. So long as teachers study science for science sake the farmer will swear at the bugs for the bugs' sake.

Far be it from me to belittle science or exalt art unduly. Art is trained common sense, and though it must stand over against the seven ancient sciences, if a comparison is made I am inclined to agree with Pope, who says:

> Good sense, which only is the gift of Heaven,
> And though no science, fairly worth the seven.

Fifty-nine experiment stations, besides the Office of Experiment Stations, and yet the pear blight, the Egyptian moth, with the San José scale, the leaf hopper, tuberculosis, and swine plague, and a host of other enemies, go on almost unchecked! Timeliness, dexterity, adaptation to environment, ability to join many forces harmoniously for securing the desired result play so prominent a part in our calling that they can no longer be ignored.

The discussion of the paper was quite general. H. W. Wiley, of the United States Department of Agriculture, insisted that rigid scientific investigation was the basis of all progress, and that every truth, every discovery, had in it a germ of usefulness to mankind. Mr. Stubbs thought it was possible to so coordinate the work of the stations as to meet both the scientific and the economic phases.

The secretary then read the report of the voluntary committee on the uniformity of fertilizer laws in all the States and the needed reforms in the inspection of commercial fertilizers. (See p. 51.)

C. A. Zavitz, of the Ontario Agricultural College, described at length the plan, scope, and growth of the cooperative experimental work done by that college. The work consisted chiefly of variety tests, and had grown from a few plats a few years ago to 2,260 plats in 1897. This growth had taken place as rapidly as the experience and ability of the local voluntary experimenter had grown or as suitable new men were found to undertake the work. The local experimenter should be well trained in the sciences relating to agriculture as well as in the business of farming. To secure trustworthy and satisfactory results, it is necessary to make a fairly complete collection of varieties of the species it is desired to test, and grow them for at least five years in a variety of localities. Along with the variety tests, systematic efforts at improvement by selection and cultivation are made. When a profitable variety is found, it is disseminated through the members of the experimental union, which is composed of the ex-students of the agricultural college and the farmers who are cooperating with the college in this experimental work. At the present time the college is carrying on seventeen different cooperative experiments, covering variety and fertilizer tests with corn, wheat, barley, oats, and turnips. An average of 79 per cent of the experimenters report the results of their work, and 35 per cent of the total number of experimenters furnish reports that are sufficiently accurate and detailed to be used. One prominent result of these experiments has been the introduction and wide dissemination of a Siberian variety of oats, a French variety of wheat, a Russian variety of barley, one new and profitable variety of peas, each from New Zealand and England. These improved varieties are now quite generally grown throughout Canada. Another value of such experiments accrues from the fact that good object lessons are constantly before the farmers in over 2,800 localities.

C. D. Smith, of Michigan, spoke on "Some special experimental problems in the Northwest."

(1) One of the leading special problems is the maintenance of soil fertility. This problem will require the closest cooperation of the bacteriologist, chemist, physicist, botanist, and farmer.

(2) The prevention of the spread of noxious weeds.

(3) The improvement and adaptation to the climatic conditions of the Northwest of varieties of grains, grasses, and forest trees.

(4) The prevention of the spread of tuberculosis in cattle.

W. J. Spillman, of Washington, followed, explaining the special agricultural problems of the far Northwest. In this region a large number of comparatively new species of grasses are found growing wild. Some of these species give promise of great usefulness in the Northwest, and should be carefully studied and improved. Another leading problem is the adaptation of suitable forage crops to that soil and climate, in order that the live stock industry may be properly developed.

A general discussion then followed concerning the value of chemical analyses of the soils, participated in by H. Snyder, of Minnesota; W. L. Hutchinson, of Mississippi, and others.

The secretary then read the report of the committee on uniformity of nomenclature (see also p. 46):

There have been submitted to the committee on uniformity in station nomenclature two or three suggestions, upon which it is not prepared to make recommendations but which it deems worthy of consideration. These are:

(1) The adoption of some uniform term to designate a fertilizer prepared by the action of acid upon tricalcic phosphate. The term "acid phosphate" has been suggested for this purpose.

(2) The use of the word "ronghage" in place of "coarse fodder." This suggestion has been objected to as being contrary to common usage in many parts of the country.

(3) Attention has been called to the desirability of some single word which could be used as a synonym for concentrated feeds.

Moved by Mr. Voorhees that the term acid phosphate be recommended for the product resulting from the application of acid to mineral tricalcic phosphate. Voted as substitute that a committee of five be appointed by the chairman to consider this question and report to the general session. Voted also that the chairman appoint a committee of five to consider that portion of the report of the committee on uniformity of nomenclature in relation to feeding stuffs, the committee to report to the general session (see p. 46):

Special committee on nomenclature for acid phosphate: E. B. Voorhees, of New Jersey; M. A. Scovell, of Kentuckey; W. L. Hutchinson, of Mississippi; S. M. Emery, of Montana, and H. W. Wiley, of Washington, D. C.

Special committee on nomenclature for feeding stuffs: W. A. Henry, of Wisconsin; C. E. Thorne, of Ohio; J. W. Spillman, of Washington; T. L. Haecker, of Minnesota, and R. J. Redding, of Georgia.

SECTION ON HORTICULTURE AND BOTANY.

The section was called to order at 4 p. m., July 13, by the secretary, the chairman not being present. H. L. Bolley, of North Dakota, was chosen acting chairman.

The first paper was by S. A. Beach, of New York, as follows:

Methods of Keeping Records of Horticultural Work at the State Agricultural Experiment Station, Geneva, N. Y.

During the seventeen years in which the Geneva Station has been engaged in horticultural investigations some features of record making have developed in connection with its work which are perhaps peculiar to that station, while other features have been adopted from other sources.

Before presenting an account of some of these features it should be said that probably there is little that is original about them, unless the results of seeking in various sources for the best methods and combining or modifying parts of them to suit local conditions can be called original work.

One of the principal features of horticultural work at the Geneva Station is the testing of varieties of fruits. Somewhat more than 30 acres are now devoted to orchards and small fruits chiefly for this purpose. Including the various kinds of station seedlings, there were more than 3,000 varieties under test at this station in 1896. Their records are generally kept as follows:

Receiving stock.—Whenever application is made to any person or firm for any variety of fruit for testing, the name of the variety thus ordered is entered in a list on a separate sheet of paper, which is to contain all the names of varieties of that particular kind of fruit ordered or received during the year. The year starts with the fall delivery season, so as to include both the fall and spring planting and grafting and the budding, which are done the following summer. The date when the stock is received is recorded on this list, with the name and address of the party from whom it was received. If the variety is to be kept under restrictions as to its dissemination, that also is recorded on this list. The list also contains the names of varieties which have been donated without first being ordered, as well as those which are ordered.

When the year has closed the lists are bound together and filed for reference. During the current season they are kept together in a binder called "Shipman's common-sense binder." The sheets used for these lists are of ordinary letter-paper size—i. e., about 8 by 11 inches, ruled, as shown in the following sample sheet from the apple list:

Fall of 1896. Apples. Spring of 1897.

Name of variety.	Address.	When ordered.	When received.
Oliver (two trees, root grafts, one year).	Prof. J. T. Stinson, Fayetteville, Ark	9-20-96	3-7-97
Longevity (scions)	N. B. Graves & Son, St. Joseph, Mo		4-18-97
Bismarck (buds)	Ellwanger & Barry, Rochester, N. Y	5-25-97	

In a separate book a record of all varieties which are received for testing is made in consecutive order, according to the date when received. In this book a station number is given to each tree, bush, or separate plant, except that for strawberries, raspberries, and blackberries a separate number is given to each package of plants rather than to each plant. The system of numbering plants is that used at the Missouri Botanic Gardens. Each number is fractional. The number of the year forms the denominator in each case. The first plant received during the year is

given the number 1 for a numerator, and each succeeding plant is numbered similarly in consecutive order as received.

Thus we see that when any variety is received it is recorded twice. One record is classified according to the kind of fruit, and is convenient in that it shows thus classified all varieties which have been ordered, as well as all which have been received. The second record is made consecutively, according to the date on which the variety is received, and has no classification of the kinds of fruits. In this record the plants are given permanent station numbers, to designate them so long as they shall be grown at the station. These records have proved so convenient for reference, especially during the planting season, that both are kept up, notwithstanding the extra work required to do it.

Planting.—When anything is planted, note of it is made at once in the foreman's journal, which is a cheap pocket notebook about 4¼ by 6½ inches in size. In this the foreman keeps a diary of all that he does each day. From this journal all planting records are posted to the proper field book.

Field books.—The field books are designed chiefly for showing when the leaves and flowers open, when fruit is in marketable condition, and the yield of all kinds of fruit, except raspberries, blackberries, and strawberries. They also may contain comparative notes on botanical features, susceptibility to plant diseases, descriptions of tree or fruit, notes on injury from winter, insects, or other causes, and memoranda concerning things which will need attention in future. The record of the yield of blackberries, raspberries, and strawberries is kept on paper, ruled so as to show the date and amount of each picking, for the sake of comparing the season of ripening of each variety. The field books, 9 by 12 inches, are bound in cloth, and the pages are appropriately ruled.

Ledgers.—From the field books each season's records are posted to a ledger having the same size page as that of the field book. The left-hand page provides for recording the name of the variety, synonyms, origin, bibliography, and description of plant and fruit. On the opposite page are recorded the station number of the plant, location in orchard, vineyard, or fruit plat, date when planted, age when planted, how propagated, kind of stock on which it is grown, condition when planted, from whom received, and the annual notes posted from the field book.

Descriptive notes, illustrations, etc.—An effort is made to keep descriptions of fruit that has been grown at the station, together with clippings of illustrations, descriptions, and other notes concerning these and other varieties which appear from time to time in horticultural or agricultural periodicals, station bulletins, and occasionally material from trade catalogues and circulars. Paper which weighs about 28 pounds to the ream, of sheets 17 by 22 inches, is cut into sheets 7 by 9 inches for this purpose. On the upper left corner the kind of the fruit is written, followed by the name of the variety.

The clippings and illustrations are pasted on these sheets, as are also envelopes which contain correspondence concerning the varieties. Descriptions of fruit which has been grown at the station or which has been sent in for examination are written on this paper, care being taken to credit to the proper source the particular specimen or specimens which are described. Each original description is signed and dated by its author. Besides the printed illustrations, the descriptions are frequently illustrated by drawings or photographs made at the station. These illustrations are usually life size. The photographs are mounted on light bristol board, uniform in size with the other sheets—i. e., 7 by 9 inches, and labeled like them with the kind of fruit and name of variety. All these sheets are arranged in drawers after the manner of a card index.

With this arrangement all notes of permanent value, except such as belong in the ledger, may be kept together, alphabetically arranged, and always ready for reference. Additions to this material may be made continually and still preserve the alphabetical arrangement.

The size of the sheet is larger than that which was formerly used. The old sheets were 5¾ by 7⅝ inches. These were abandoned, because they could not be used for mounting many of the life-size photographs which required a 5 by 8 inch plate. The size 7 by 9 inches which is now used will easily accommodate a 5 by 8 inch print and leave some room for label and descriptive notes. A lighter-weight paper than that now adopted was formerly used, but under the card index arrangement it was not firm enough to stand up well.

Crosses, hybrids, and pure-bred seedlings.—A second line of work which has received considerable attention is the origination of new varieties of fruits and vegetables. Blank books, 7½ by 9½ inches, with board covers, are used for recording the pollination of stigmas in each blossom or cluster of blossoms for this purpose. Each flower or group of flowers covered by one bag is numbered and notes on the fruits or seeds produced by them are recorded under the number given to the flower or flower cluster. As soon as the new seedlings appear and are sufficiently well established to be transplanted to seed beds or nursery row each one is numbered as a station seedling.

The plant is known by this number till it is either discarded or given a permanent name. For example, the strawberry which was at first given the number 198 has been named and is now known as the Hunn, while nearly all the 200 or more seedlings which originated at the same time with it have been discarded. Each kind of fruit is given a separate series of numbers, so that we may have a station seedling grape No. 75, a seedling gooseberry No. 75, a seedling currant No. 75, etc. After any number has once been given to a seedling in any series it is not afterwards given to any other plant in that series, even though the plant to which it was first given has been destroyed. Thus station seedling strawberry No. 75 has been discarded and destroyed, yet to avoid possible confusion no other station seedling strawberry is to be given that number.

The records of the station seedlings are kept in the record book last described till the plants are given a permanent place for fruiting, after which the records are kept in the field book along with other varieties. No record of station seedlings is transferred to the ledgers until it has shown sufficient merit to encourage continued testing of it.

Nursery records.—All nursery operations are first entered in the foreman's diary. From this the records of such work are posted to a nursery book, in which notes on the varieties in the nursery are kept till the plants are taken from the nursery.

Records of investigations not connected with variety tests.—Work which requires many descriptive notes and numerous tabulated observations are commonly kept in a book 7½ by 9½ inches, in board covers, like that used for records of hybrids and crosses. For convenience in reference, these books are numbered consecutively. It is considered desirable to make a preliminary written statement of the considerations which led to undertaking the investigation. This is followed by a statement of the object of the work, and the plans for carrying it out. By referring to this statement the original plan, in all its details, may at any time be clearly brought to mind. Later modifications of the original plan should be recorded in a similar way.

As soon as any experiment is determined on, and sometimes before, it is entered on a list of experiments and given a number, for convenience in note taking. The progress of any line of investigation is frequently accompanied by the accumulation of such material as drawings, photographs, clippings, correspondence, notes, references, etc. It has been found convenient to put such material, as soon as it comes to hand, in a cover or folder made of medium-weight manila paper, labeled in the upper right corner with the name of the subject. These manila covers, with their contents, are usually kept in a case of shallow drawers. Should occasion demand, as frequently is the case when a report of the work is being prepared for publication, an entire drawer, or more than one, may be used for the accumulating material. Whenever the work on the report is interrupted, the papers may be laid in the drawer, where they remain undisturbed. At any time thereafter when work on this subject is resumed all papers and material pertaining to it are collected in one place and accessible in a moment.

I find in my work a tendency to use the bound blank books less, and instead use the loose sheets inclosed in covers of manila paper. The sheets may readily be put side by side for comparison and changed about whenever it is desired to do so. If there are not too many of them, they may readily be held together by such simple devices as the "gem" clip, or "Angell paper clamp." These, when removed, leave the sheets loose and unmutilated.

For records of a less elaborate kind than those last considered smaller sheets of paper may be used. I find the size 6 by 3⅝ inches very convenient. It is cut from Berkley sheets 17 by 22 inches, 28 pounds to the ream. For convenience in indexing and filing, the subject of the note or reference is written in the upper left corner. If the note pertains to an experiment, the number of the experiment follows the name of the subject.

A Russia-leather cover, held together by a rubber band, is used for carrying these small-sized sheets in the pocket, and thus the bound pocket notebook is dispensed with. The notes formerly put in such notebooks and buried in the accumulation of a few months so that it may take half an hour to find some particular reference to them are now indexed by subjects when the notes are made and are kept filed in alphabetical order, ready for reference at a moment's notice.

On trips away from the station this method of note making is found especially convenient, as the notes may at once be arranged alphabetically and filed according to the subjects treated as soon as one returns home. Other notes of interest which may not pertain to any special experiment may likewise be filed so that they are readily accessible.

Photographs.—Photographs are largely used for illustrating varieties of fruits and vegetables and for showing various phases of work which may be illustrated in this way. The plan is to keep a card index of the negatives so that any negative may readily be found by first consulting the card index so as to find the number under which the negative is filed.

H. N. Starnes, of Georgia, read the following paper:

THE IMPORTANCE OF MYCOPHAGY IN A COURSE OF BOTANICAL INSTRUCTION.

While this paper is not intended to be argumentative, but merely suggestive and for the purpose of provoking discussion, it may be well to advance a few reasons to sustain the position that at least a short course in practicable mycophagy should occupy a place in every system of botanical instruction, even where the curriculum has been heretofore so elementary as to omit altogether a study of cryptogamic life.

It is suggested that a course in practicable mycophagy would redound to the benefit of three distinct classes:

1. *The masses.*—As yet in ignorance of its importance.

2. *The beginners.*—Those who already realize its value and would pursue the subject further.

3. *The capables.*—It could be made the means of assisting by concerted experimentation, investigation, classification, and general research those who are now considered by others well versed in the science; for it is doubtful if you could find anyone, not even McIlvaine himself, who would be willing to admit that he had advanced any further than the threshold.

In the first place, then, as regards the masses, it is admitted that meat is daily becoming dearer; it is also admitted that the edible fungi can, to a great extent, be substituted therefor, as the chemical analyses of many varieties prove. Now, while the inhabitants of many portions of Europe, notably our thrifty friends the Germans, actuated by necessity, have long since accustomed themselves to the general use of fungi as food, the peasantry having become practical if not scientific mycophagists through generations of hungry experimenters, our own people are just waking up to the availability of the toadstool as an article of diet. Prejudice (primarily induced by the name itself) has heretofore retarded progress in this line. Now, however, with "the wolf at the door," with meat advancing in price as the population becomes denser, they are daily becoming more and more ready to discard prejudice for progress. Fortunately, as American civilization grows older and European conditions are paralleled, as the soil is nursed and manured and fostered by a denser population, it becomes year by year richer in nitrogenous matter, and the spontaneous growth of fungi will proportionally increase, and nature will thus be able in the near future to present a logical and reliable substitute, inexpensive and easily obtained, for the higher-priced meat products that will soon become here, as in many portions of Europe, beyond the reach of the ordinary wage-earner.

So it would appear that the time is now ripe to educate the American public up to (at least) the standard of the Rhenish and Norman peasant, up to a point where it will be willing to abandon the prejudice inherited from its insular ancestry, and prepare it for what in the near future will be recognized, if not as an actual necessity in the battle for existence, at least as an admitted universal luxury.

The work is even now afoot—the leaven has already begun to work—sporadically, as yet, it is true; but our second class, the beginners, is in the field, and it is very evident that the American people—"some of the people," at least—have become interested in the matter and will soon be clamoring for the very instruction and opportunities that it is suggested you take the steps to supply.

Thirty years ago not half a dozen scientists in the United States had written a word on edible fungi; hardly more than that number knew anything at all about them. Dr. Curtis had spent a lifetime in their study, but his experience was not circulated in an available form, and the numerous errors of Badham and Cooke and other British mycologists were repeated and stereotyped, and in their contradictions and general fogginess perplexed and befuddled the beginner to such an extent that there was little encouragement and no enjoyment in pursuing the study.

Fortunately, such men as Julius Palmer, William Hamilton Gibson, and Charles McIlvaine have of late years rendered it possible for a beginner to acquire at least a taste for the study, and the result is that there are now hundreds of enthusiastic amateur mycophagists scattered from Maine to Mexico where there were, thirty years since, scarcely an average of one to a State.

Yet the difficulty is these amateurs, however enthusiastic, can not progress as they wish. They go so far, but no farther. As a rule, they have no one to advise them and must "dig it out" by themselves. It is true a most praiseworthy effort is being made in certain localities to form mycological clubs for the benefit of the public. Such are the Philadelphia Mycological Center (with the distinguished Captain McIlvaine as president), the Boston Mycological Society, and there may be others. These societies hold monthly meetings for field investigation and lectures, and publish bulletins of their proceedings. To them anyone, from any part of the country, is free to send specimens for identification. But this is most inconvenient where the sender resides, perhaps, 2,000 miles away, and while these organizations are undoubtedly in a position to effect a great deal of good their efforts can be vastly facilitated by the cooperation of the agricultural colleges and experiment stations.

Now, as to the capables. We all know that doctors can disagree. When they do, although there may be no one at once competent to decide, yet a decision may eventually be arrived at if we only "let in more light." One illustration will suffice.

I had been taught to regard the *Amanita cæsarea* as the "king of edible fungi." Every writer on the subject from Badham and Cooke down to Hamilton Gibson has pronounced it a distinct and separate species from other *Amanitas*, and not only edible, but delicious. Dr. Taylor, in the United States agricultural reports, pictures it in colors, minutely, beautifully, and exactly, and tells the public it is harmless. It is indeed one of our handsomest and most abundant toadstools. But, being an *Amanita*, I had always fought shy of it. Captain McIlvaine, on the other hand, had stated to me that he regarded it as merely an amorphous form of the *A. muscaria*—one of the deadliest of fungi. Yet Prof. F. S. Earle, of Alabama, had told me that he regarded it as entirely distinct from the *Muscaria*, and gave his reasons therefor; while a recent bulletin of the Alabama Station by Dr. Underwood and Professor Earle has also classified it as distinct and pronounced it edible.

Well, I sent several specimens of the *A. cæsarea* to Captain McIlvaine, who was then at Haddonfield, N. J. With the intrepidity of a true scientist (and a Scotchman) he had them prepared, made a meal of them, and eight hours afterwards seated himself in front of a mirror, hypodermic in hand, and calmly watched the leaden, deathly pallor indicative of amanitine poisoning slowly overspread his features, applied his syringe of atropine, and of course recovered to testify that either the *A. cæsarea* is an amorphous form of *A. muscaria*, or, if a separate species, is as deadly as its sister.

"Who shall decide when doctors disagree?" Why, who but the botanists of the experiment stations? And they can easily do it by employing a mangy cur or some of Pasteur's rabbits or guinea pigs as subjects, and thus prevent so valuable a life as that of our good friend Captain McIlvaine from being again risked in the enthusiasm of his devotion to science.

Now, as to methods, I have nothing to suggest. I do not regard myself as competent to do so. Method must necessarily be largely determined by each individual instructor, although it is probable that such matters as the selection of text-books, character of field work, etc., could be arranged by concert to better advantage than would be the case were each instructor left to map out an entirely independent course.

I have only one suggestion to make. Let the course be a practical one: it is suggested more as an adjunct to than a part of strictly botanical study. What matters it to the average student who never, perhaps, contemplates taking up botany as a scientific pursuit whether he is able or not when he finds an *Amanita vernus* to classify it as belonging to the family of *Hymenomycetes*, order *Agaricini*, genus *Agaricus*, and subgenus *Amanita?* What he wants to know is if it is good to eat and how to tell it. It is sufficient for him if he learns its name, the features by which it may be always identified, and that it contains the deadliest and most insidious poison known to mycologists.

Of course, if the instruction can be made scientific as well as practical, so much the better; but do not sacrifice the latter to the former. Scientific knowledge may be the gainer in the one case and human life the loser in the other.

As chairman of the committee on plant registration, L. C. Corbett, of West Virginia, presented the following report:

Report of Committee on Plant Registration.

As chairman of the committee appointed at the Washington meeting to consider the feasibility of a scheme for plant registration, I submit the following, which is more in the nature of a report of progress than of definite recommendations:

Upon returning from Washington last November, I, as secretary of the section, sent letters to the several members of the committee, which consists of Prof. L. H. Bailey, Prof. F. S Earle, Auburn, Ala.; Prof. C. H. Shinn, Berkeley, Cal.; Prof. W. A. Taylor, United States Department of Agriculture, and myself. Each member of the committee responded promptly to my letter, and each expressed himself as in hearty accord with the project

Besides the members of the committee already named, a circular letter was sent to the leading horticultural and agricultural journals of the United States. In two of these journals, the American Gardening and the National Nurseryman, the subject has been criticised both in an adverse and commendatory spirit.

The letter published is as follows:

"The idea is to have some one place in the United States where all plants placed upon the market can be officially registered, numbered, and a description, together with specimens of the bloom, seed, foliage, and fruit, placed on record. When it is not practicable to preserve the original, colored casts are to be prepared, as in the case of citrus, drupaceous, and pomaceous fruit, as well as vegetables.

"In all cases where plants are sent for registration, specimens of flowers, foliage, fruit, root, tuber, or seed must accompany the application. All vegetables must be accompanied by a given amount of seed (to be determined), to be preserved for purposes of noting the duration of cultural varieties, the influence of climate during any series of years or in any locality. A further purpose of the seed shall be to grow plants for purposes of identifying the sort.

"ENDS SOUGHT.

"(1) To discourage the duplication of names and the renaming of old sorts for commercial purposes.

"(2) To form a national herbarium of economic plants, which shall be made up largely of type specimens.

"(3) To simplify the matter of nomenclature.

"(4) To aid the student of varieties as well as of variation of plants under culture.

"(5) To secure the originator of a truly valuable variety some reward for his labor, the same as is now accorded the inventor.

"The incorporation of such a clause (No. 5) will undoubtedly secure the hearty cooperation of all plant breeders, nurserymen, and seedsmen, and this cooperation we must have in order to advance the scientific ends sought.

"It is further proposed that this central bureau be made a part and parcel of the present Division of Pomology of the United States Department of Agriculture. A very valuable nucleus for the beginning of such work is had in the fruit models now in the museum of that Department.

"Each person interested in this matter will kindly formulate his ideas on the subject and send to some member of the committee, who will put them in such form that a bill may be drafted at an early date and presented before Congress. The idea in having the members of the committee so scattered is to get the needs of the several sections of the United States as well represented as practicable. It is hoped that each one interested will lend hearty cooperation in the matter."

Notwithstanding the fact that no mention of testing varieties is made in the letter, several correspondents to American Gardening borrowed that supposition, and from that hypothesis as a basis started out with a tirade of adverse criticism of the scheme, which to my mind is primarily intended to aid the practical horticulturist, and as a secondary consideration, to build up a herbarium and fruticetum for the study and identification of cultural varieties.

A brief summary of the expressions of the press may be of service in aiding to arrive at some conclusion in this matter. With this in view, I here present in substance the more important arguments which have appeared, both in favor of and against the project.

In the January issue of American Gardening, page 790:

"There has often been expressed, in the pages of the horticultural press, a feeling that some central organization should have on hand the work of keeping accurate records of existing varieties of economic plants, and where, also, all new introductions should be recorded, by description, history, and actual specimens, so far as practicable. Those whose business or professional work necessitates their continually making comparisons between old stand-bys and recent novelties have realized only too well how much uncertainty there is in memory pure and simple. * * * There is no necessity to insist upon the evils that result from the present loose methods of certain reputable tradesmen who, without scruple, introduce old subjects under new names; or, still worse, dub with a name to catch what has already been condemned as worthless under some other title. This holds good equally of the seed, the nursery, and other branches of the horticultural trade, and any movement aimed at those tactics should receive the hearty support of all, and most decidedly so of the leaders in the business of supplying stock to the purchasing public."

This was followed in the issue of January 2, by Mr. Howard Miller, of Union County, Pa., who makes this statement:

"The writer, without claiming to be an expert or an authority in the plant world, has often felt the need of some more definite means of locating the value of fruits and flowers than the descriptions offered in the catalogues of interested persons. The business of propagation and dissemination is in the hands of live men all over the world, and a more active and energetic lot, both in real practice and the exercise of their imagination, would be hard to find.

"Now, in reference to this proposed registration business, let us take a hypothetical case. When I was a good deal younger, there was a man in Pennsylvania intelligently interested in small fruits. He noticed that a certain strawberry, the seven hundredth in the row, was a better one than the others, and he immediately began to propagate and boom it.

"Suppose, now, that this registration bureau had been in full blast, and he had taken advantage of it. The first thing to do would be to send a lot of his berry plants to Washington for determination of their value. Then he would have to

wait until his certificate came, if that was what he wanted; and if he did not want it, what was the use of sending the plants at all?

"Now, the Department would have to test the plant; and supposing it did, and that it proved a very good berry in the sand and climate of Washington, is that any guaranty that it would do well in the mountains of North Carolina, the levels of Louisiana, or the prairies of the Dakotas? The only way to determine that would be to send out plants all over the country, for if there is any one thing that is settled, it is that there is no plant in existence that will do equally well in all sections of our widespread country. By the time the reports came in and were analyzed, and the case made up and ready for certification, years would have elapsed. Suppose, now, that it was all that was claimed for it, which is possible, it is utterly impossible that it should be universally so, what good would his long-delayed certificate do him in a commercial sense? He had emptied his fish into the head of the stream and they had gone to the ends of the river, and had proved a good food-fish. If he sets his net now at his home, does he expect a monopoly of his fish? If he does, he will be disappointed. In the very effort of determining his find he has practically given it away. The writer claims to be fairly patriotic, philanthropic to a degree, and as honest as the times allow, but he is under no obligations to get a package of plants from the Department of Agriculture, test them, turn them around in various ways, and then, when they have proved superior, dig the whole lot up and return them or burn them. On the contrary, if the plants sent me proved valuable in a commercial sense, and I had no contract with the party sending them, I would at once propagate and flood the country with them, while the Bureau was thinking about it and making up the reports. If you think this is dishonest, tell me how I am under any obligation to take your setting of eggs, hatch out a lot of 'pee-pees,' raise them, compare their weight, color, and all that, and then send the whole outfit back to you, whom I have never seen, and who will immediately use my name and certificate for your own personal benefit. I believe in reciprocity; and who is going to pay for all this experimenting?"

I quote this at length to illustrate how completely intelligent readers can become befogged, and to illustrate the extent to which a man will go to distort another's statement in order to give precedence to his own pet ideas. The meat of this nut is found in the following paragraph from the same pen:

"I think that my original suggestion of a novelty catalogue a good thing if it could be arranged properly between myself, the producer, and the buyer of seeds and plants. In the very nature of things it would be ahead of the Government from three to five years. It is well known that there are thousands of people who run to specialties; this year and next they raise pansies, then they take to roses, and so on. There is no one person living who gets all the catalogues of specialists, and it is next to impossible to do so. It is proposed to collect in one catalogue all the latest introductions under their appropriate heads, with the names of the propagators, thus showing at a glance where the best things are to be had and for how much money. Whether they were really the best of their kind could not be determined by any Government bureau, though it might come trailing along with its reports sent through your Congressman long after you had settled it all for yourself."

On page 36 of the current year of American Gardening I published the following explanation:

"In your issue of January 2, page 12, Mr. Howard Miller presents his ideas in regard to the proposed bureau of plant registration. As a member of the committee, I wish, if possible, to correct false impressions or misapprehensions in regard to this matter.

"In the first place, the idea of plant registration is not the testing of varieties; neither is it to be made a means of distributing seeds or plants. It is not intended to handicap the originator or introducer of a new variety or species, but, on the other hand, to give him a sort of precedence by an official guaranty in the form of a registration number and a recognized name. It is not the idea that plants can be copyrighted, but that the general public will, in self-defense, buy only officially registered stock. The person, therefore, who neglects to procure official recognition from this national agency will be disregarded by enlightened buyers, and in order to successfully compete with others in the same business he will find it to his advantage to procure the Government seal upon his introductions. It will work the same as the fertilizer laws do. Manufacturers have their goods analyzed and registered in West Virginia, because they wish to put them on the market in that State, and because they know that intelligent buyers will not purchase a brand that does not carry the marks of registration given on all brands analyzed by the experiment station of that State. I anticipate that it will not be long before people will be as careful to require the official tag on fruit and ornamental plants as are the purchasers of commercial fertilizers nowadays.

"To comply with the requirements of this proposed bureau would be no hardship, and would entail no loss of time to the originator or introducer, for certainly no conscientious grower would put a plant upon the market before having thoroughly

tested it for himself, and before he had produced a stock sufficient to meet the requirements of introduction.

"The idea of a novelty catalogue is a good one and would be of great aid to all classes of growers, but it does not and can not cover the ground of the proposed registration system. The one in no wise interferes with or overlaps the other.

"The aim of the proposed scheme is to defend both buyer and seller; to eradicate fraud and the factors which stimulate falsehood and misrepresentation on the part of agents and advertisers. It is hoped that the official number will be considered as binding as a bond upon producer and seller, and the fraudulent use of the privilege shall be made a misdemeanor, subject to heavy penalty."

I quote another paragraph from the same issue of the above-mentioned journal. It still further perpetuates the misapprehension incorporated by Mr. Miller in his article in the issue of December 1. The quotation expresses the sentiment of the writer far more clearly than I can. It is as follows:

"It is well known that in all departments of the Government there is so much of 'red tape,' which, I suppose, is necessary, that the institution of a department such as is proposed, compelling each originator of a new fruit, grain, forage, or textile plant to first place it in the hands of a Government bureau to test and determine its value, and which bureau would be at liberty to consume all the time it fancied in making and reporting as to its merits, would be to place the originator of a plant of possible value in a position that would be an injustice to him. Its effect would be to, in a great measure, discourage people who take an interest in experimental work from making further efforts in the crossing or hybridizing and growing of seedling plants. Besides, in order to establish a Government bureau that would be qualified to intelligently pass upon the merits of a new fruit or other plant, it would be necessary to have substations in at least every Congressional district in the country. Even should the reports from a majority of these stations be favorable to a new fruit or plant, the report would be of but little value to the average planter."

On page 106 of the February 13 number, another correspondent, Mr. Charles Wright, of Delaware, expresses himself as in favor of some such scheme as that proposed in my letter in the December number, but he commits himself to the fallacy of believing that all the good that can come from such a scheme is in its function as a testing bureau.

In this connection I can not refrain from quoting an editorial in the January 23 issue, which to my mind should have dispelled all doubts as to the aim of the movers in this matter. I quote it in full, as follows:

"Since we first drew attention to the proposition to establish a bureau for the registration of new introductions of fruits, etc., there has been some correspondence upon the subject, and so far no decidedly favorable comment. No doubt the intention of the proposers has been misunderstood. It would not be practicable nor politic to endeavor to coerce the fruit grower into a submission to a prolonged testing of his novelty, nor could there be any hope for the success of the proposed bureau if it were to arrogate to itself anything approaching the duties which by some of our fruit raisers have been assumed to be the objects.

"Fruit growers themselves suffer from the present methods of introduction. That is acknowledged by themselves. It was brought out before the New Jersey State Horticultural Society's meeting by L. J. Farmer, of Pulaski, N. Y. The evil exists. How shall it be met, how remedied?

"As was ably demonstrated by our correspondent, W. H. Ridgeway, in last week's issue, no reports, no tests, no opinions can be relied upon by the commercial grower as to whether a given variety will do well with him. The various factors which combine to make a variety a 'good thing' for one man to grow are not the same as those sought for by his neighbor. The two men may cater for different markets; perhaps their soils and methods are not identical, and that some one variety does well everywhere only proves its power of adaptation to varying conditions.

"But what is wanted is the guaranty that a novelty offered to the public is distinct from others already in existence, and if the proposed bureau undertook merely to certify to that one fact we opine that it would be welcomed by the better class of fruit growers and novelty raisers. And this argument holds good not only of fruits, but also of all other garden stock. The flowers, the vegetables, the trees, and shrubs should be placed before the public with the guaranty of distinctness. Surely the public would be more ready then to invest money in a novelty. So far as the florists are concerned the principle here advocated is already an accepted principle; then why not also for fruit raisers?"

In the June number of the National Nurseryman the question was further discussed, and in the following statement I again set forth my views upon the subject:

"The matter is still being agitated, and when it becomes possible to convince people of the importance and aim of the movement, there is no difficulty in getting their hearty support and cooperation. The difficulty has been, so far, that those to whom the movement would bring the most benefit have been those who have brought the most opposition to it. Nearly everyone who has written a criticism of the

scheme has understood it to be some movement which had for its aim the duplication of the work already done by the experiment stations. That is, that there was to be some Government establishment where all varieties, no matter what their origin, were to be tested. This of course would take a series of years, would require the employment of a large force of hands as well as a large territory. They have further misconceived the idea in that they seem to suppose that such a central station could be made practicable.

"From the very nature of the case of testing varieties such work must be done at the several State stations in order that the climatic conditions suited to the variety of products grown in the United States may be taken advantage of. Briefly stated, the object of the bureau of plant registration is merely to have an official recognition of importations as well as varieties, so that those introducing or importing them shall have the protection that such a guaranty would carry with it. It is not the purpose to test varieties in any sense, but merely to record them and to give the introducer or importer the first right in handling them.

"No official meetings have been arranged for, and it is hoped that the scheme can be put in operation without the enactment of new laws, either through the head of the Division of Botany or Pomology of the United States Department of Agriculture. This, of course, would necessitate a somewhat increased appropriation to the Department undertaking the work, but those best informed in the matter seem to think that no new legislation is necessary. Therefore the third question as to the drafting of the bill is disposed of in this way.

"I think there is very general interest in the matter, and if we can only get importers and growers to take an active live interest in the scheme there will be no trouble in carrying it ont. All of the experiment station horticulturists with whom I have corresponded take an interest in the matter, as they think it will not only be of great scientific value, but a direct aid and benefit to those engaged in the propagation of new varieties. Professor Bailey's ideas on the subject were very clearly set forth in his Annals of Horticulture for 1890."

OPINIONS OF OTHER MEMBERS OF THE COMMITTEE.

Professor Bailey writes, November 27:

"I am much interested in the work which you have in hand. Yon will find my views of the registration of plants, together with historical data, in my Annals of Horticulture, particularly in the volume for 1890. I look upon a bureau of registration as a means of collecting and preserving knowledge, rather than as a means of protecting originators of varieties, although I think that this latter result will come incidentally. But varieties may originate twice, in which case one originator has as good a right to the variety as the other (see Essay 11 in Survival of the Unlike). It is also true that the varieties propagated exclusively by seeds, like the garden vegetables, very often run out by variation in different parts of the country within a few years, and the person who obtains a new strain, or type, or variety by this means is fully entitled to whatever benefits may accrue from it. In other words, varieties are not entities, and they can not be patented and copyrighted as machines and trade-marks can. However, the incidental protection which would come to originators of varieties from such a bureau of registration would be very great. At all events, the name itself could be copyrighted as a trade-mark, and that would practically control the offspring of any variety which could be shown to be a lineal and little-modified descendant of the original varietal stock.

"As a means of collecting and sorting and preserving information, however, this proposed bureau would be of immense value, and I should be glad to lend whatever influence I may in the endeavor to secure it."

In February 6 issue of American Gardening, Professor Bailey gives public expression as follows:

"In response to your request for my views upon the proposed establishment of a bureau of registration for varieties of horticultural plants, I may say that I have already pretty thoroughly expressed myself upon the subject, giving at the same time what historical data I was able to collect. These notes will be found in my Annals of Horticulture for 1890.

"I look upon a bureau of registration as a means of collecting and preserving knowledge rather than as a means of protecting the originators of varieties. I believe, however, that the existence of such a bureau would result in a great incidental advantage to originators, for the public would soon learn that those originators and introducers who are willing to make the most complete and careful record of their novelties are the ones who, as a rule, are to be most fully trusted. Varieties are not entities like machines; they are not fixed and invariable, but they vary under the influence of every modification in soil, climate, and cultivation, and they can not therefore be patented as inventions are.

"I was not present at the meeting which adopted this proposal for a bureau of

registration, and was not aware that I was placed upon the committee until informed some time after the meeting by the chairman, yet I am most heartily in sympathy with the proposition, as I understand it.

"I do not understand that there is any desire to attempt to compel people to register their varieties, as one of your correspondents fears; and there certainly can be no successful attempt to copyright a variety itself. The nearest that we can come to such protection is to copyright the name, and to use that name as a trade-mark. It is certainly true that a variety may originate more than once; that is, that plants which are so near alike that there is no commercial difference between them may originate in different parts of the country. This being the case, it will be seen that no man can have the exclusive right to any particular type of plant. A discussion of this very point respecting the origin of varieties is discussed in chapter 11 of my Survival of the Unlike; but leaving aside all this matter, the collection of specimens, photographs, and descriptions in the hands of a bureau of registration would give us an inexhaustible repository of information, and could not help but result in incidental and very substantial recognition of the introducers of novelties. Rather than acting as a discouragement of experiment, as one of your correspondents suggests, it would result in a direct stimulus thereto; but I am free to confess that it might discourage the dissemination of various novel names of old varieties."

Under date of December 4, Professor Earle writes:

"Your letter of November 24 seems to have covered the ground so thoroughly that I do not know that I can add many thoughts of interest. It occurs to me, however, that in the case of varieties of fruit trees—especially such as would stand the climate of Washington—it would be very desirable to require the deposit of, say, two well-grown nursery trees of each variety to be registered, and that those should be planted and cared for as the nucleus of a horticultural botanic garden; this, of course, provided suitable ground could be secured. In time such a collection would prove of the greatest interest. Of course, the idea could be elaborated by providing houses for growing tropical things, and gardens for cultivating annual varieties, but this would require a much greater expenditure than to provide for the hardy, woody varieties only.

"In addition to the casts, etc., of perishable fruits and vegetables, I would suggest the requirement of life-size photographs of the fruit and of other photographs of the growing plants.

"Your No. 5, under ends sought, is a very important point, and it will require careful consideration how to frame a law that will give the proper protection to the originator without proving an obstruction to trade. I confess I have not given the subject sufficient thought to be able to formulate one."

While Director True is not a member of the committee, I thought it might be of general interest to the section to have his views upon the matter, and accordingly I took the liberty of writing to him. In reply he says:

"This certainly would be a very desirable thing to have done, and agitation of the subject ought to be useful. From what little study I have been able to give to the plan, I am inclined to think that it is too big a thing to be undertaken all at once. Undoubtedly the work of the Division of Pomology needs to be developed, and it might easily be developed in the direction indicated in this plan. I should say that it would be best to take up certain classes of plants and work up a good plan for the registration of these, and let the work be extended from time to time as plans for carrying it on were fully matured. Some time ago this Office, in cooperation with the Division of Pomology, undertook to prepare a list of introductions of horticultural plants, following the plan of Professor Bailey in the Annals of Horticulture. For reasons beyond our control, this work has been greatly delayed, so that we have not as yet published anything. We have, however, gotten together considerable material, and hope to follow this matter up and before long provide for the regular publication of introductions from year to year."

Besides the correspondence already spoken of, I received numerous letters from horticulturists of other stations and from persons in practical horticultural work. In nearly every case the writer gave full assent, or had some substitute for the whole scheme. In one case the idea was to turn all soldiers' homes into experiment stations or test grounds. The work to be done was what is now being done at our stations. The main argument in this case was that the Government or State owned the ground.

Many schemes for the elevation of the horticultural interests of the country and for the advancement of agricultural education have been suggested, but outside of station workers and editors few seem to have formed any true conception of the aim of the work of your committee.

I am, therefore, much at sea in regard to the proper step to take at this time. I opine, however, that someone else had better take this matter in hand, and perhaps they will be more successful in reaching the pitch to which public sentiment is attuned and be able to elicit the support which, it seems to me, we must have before

this can be made a successful working feature of any national bureau. We must have the cooperation of the nurserymen, the seedsmen, and the importers. The success of the plan does not rest with the experiment stations, nor yet with the practical agriculturist, but with the plant breeder and the plant and seed dealer.

After hearing the report the section appointed a special committee, consisting of E. S. Goff, W. R. Lazenby, and W. M. Munson, to consider the report and to make recommendations. For recommendations of the committee see page 54.

A paper prepared for the section by R. H. Price, of Texas, was read, as follows:

Classification of Varieties of Peaches.

That there are well-defined types of peaches which behave differently in the same latitude is well known, and some knowledge of the classification of varieties as affected by climate is necessary, not only to the practical grower, but to the scientist as well. The peach has been so modified by climatic influences and crossing of the different types that it is difficult to devise a system which will include all varieties and not be subject to some criticism. But if a system can be devised by which one can distinguish a large number of varieties and predict within a reasonable degree of cer-

Fig. 1.—Seeds of different races of peaches: 1. *Peen-to;* 2. *South China* (Honey); 3. *Spanish* or *Indian* (Texas); 4. *North China* (Chinese Cling); 5. *Persian* (Old Mixon Free). (Original.)

tainty which types are likely to succeed in a given section, a long step is made in the direction of most valuable knowledge. The one based upon the presence or absence of glands on the foliage is of considerable value in distinguishing varieties in the nursery before they fruit. But we have varieties which bear different glands upon the same tree. Seedlings from a given variety may bear entirely different glands, and vary also in the adherence or nonadherence of flesh to the pit. And this is true even when the variety has been fertilized by its own pollen.

There are types coming from China, Japan, and Java, and others which are now being built up in the southern part of the United States, which the above points do not distinguish with clearness. We have seedlings from the Honey Peach which came from China in 1854; seedlings from the Peen-to, which came from Australia in 1869; then again there are seedlings of the Spanish or Indian type; all of which are adapted to more southern latitudes than those of the Persian strain, which constitute the bulk of northern orchards. These new types are proving valuable along the Gulf States, where the peach has not been grown as successfully as it has farther north. It is important now that the botanical characteristics of each type (which we shall call "race" for a better term) should be recorded with clearness, and the climate in which each grows best be pointed out as clearly as possible.

During the past four years the peach has been one of my special studies. Our experimental orchards contain 190 varieties. Large experimental orchards have been

studied near the Gulf and over a thousand miles farther north. From what I have thus learned it seems to me that what is known as the "Onderdonk classification" is the best. An outline of this scheme appears in the report of the United States Department of Agriculture for 1887, page 648. Some of the distinctions made in this classification can not be noticed with decisive clearness a few hundred miles farther north, but in the semitropical climate of the coast region the characters are striking. This at once indicates that the different races originated in different degrees of latitude and at different altitudes. These facts are further substantiated by the botanical characteristics. We divide the peaches now cultivated in the United States into five races: (1) Peen-to; (2) South China; (3) Spanish or Indian; (4) North China, and (5) Persian. By race is meant "a variety so fixed as to reproduce itself with considerable certainty from seed."

Seed characteristics.—The shape, size, and corrugations of the seed are so well marked in the more distinct representatives of the different races that after a little practice one can distinguish them apart by this means alone. This can readily be seen from the illustration (fig. 1, p. 82). It will be seen that the seed of the Peen to is nearly round, much compressed at the ends, corrugations small and somewhat rounded. The seed of the Honey is oval with apex slightly recurved, corrugations slight, prominent flange on one side. Seed of Spanish is large, oval, nearly flat, apex prominent, corrugations very long and wide; at the base they run more longitudinally than in any other race; flange on one side often prominent. Seed of North China is nearly round, very thick, corrugations rather slight and irregular, apex rather prominent. Seed of the Persian is somewhat round, more flattened at the base than any other, corrugations prominent toward apex but very seldom extend to base; apex more or less prominent. A resemblance can be seen between the Spanish and Persian, and as there is no definite history in regard to the origin of the Spanish, it is probable that the types had the same origin. The Indian type of the Spanish can only be distinguished from the Persian, in many cases, by the heavy down on the fruit, which is characteristic of the Spanish.

THE DIFFERENT RACES AS AFFECTED BY CLIMATE.

I. *Peen-to* (*Prunus platycarpa*, Decne).—Tree rather large; branches vigorous, willow like, branching at an angle of about 40 degrees; flowers large, opening early, frequently in January in the Gulf States, often at a low temperature and very irregularly; leaves narrow and long, inclined to be evergreen; fruit much flattened; skin white and mottled with carmine; flesh white; flavor sweet, with peculiar almond twang. It is adapted to the northern part of the citrus belt, in which climate it ripens from May 1 to June 1. It has a tendency to sport, and some valuable varieties are now coming from it for the extreme southern part of the Gulf States, where other races will not grow successfully.

II. *South China race.*—(The parent of this race is the Honey Peach, *Prunus persica* B. and H.). Tree medium sized; branches leaving the trunk at an angle of about 50 degrees and curving upward; buds quite prominent; flowers always large and very abundant, with greater resisting power against cold than any other race tested in this climate; has borne crops annually during the past four years, when many other varieties belonging to different races failed; foliage small, slightly conduplicate, distributed all along the limb, color dark green, in fall slightly tinged with red; requires short season of rest; fruit rather small, somewhat oval in shape, slightly flatted, suture very deep at basin, but does not extend more than one-third the way down; apex long and recurved; flavor peculiar, honey sweet. Supposed to have originated in southern China, from which the seed came. This race is adapted to more southern climates than any other, except the Peen-to. Honey seedling are proving very valuable for the southern Gulf States.

III.—*Spanish race.*—Tree very large, except in Indian type, which evidently has considerable Persian blood, judging from the color of the young wood, which is reddish, the naked places on the bearing wood, and the corrugations on the pit and its general shape; limbs large, long, and spreading; branches low and drooping; flowers nearly always large; leaves small and flat, persisting late in fall and turning slightly yellow; fruit very decided in character, ripening very late, nearly always yellowish when mature and covered with heavy down. In the Indian type the fruit is striped with red; a heavy bearer and sure cropper in its proper isotherm; seems to have come from the Indian type brought over from Spain by the Spanish missionaries and distributed among the Indians of the extreme Southern States. Perhaps it is owing to successive seedlings in more favorable climate that the type is now varying. All over the Southern States one hears the expression that seedlings are surer bearers than budded trees, and there seems to be some truth in this belief, because by growing seedlings continuously varieties may adapt themselves to climate. This type is adapted to isothermal lines north of where the South China race flourishes.

IV.—*North China race.*—The original Chinese Cling, which is a dwarf tree near the coast, is the parent of this race. It is not at all adapted to regions along the Gulf. Two or three hundred miles farther north it and its seedlings do well. It is the parent of the largest peaches in the United States; blooms later than the Persian, and the flowers are nearly always large; foliage large and flat, turning toward autumn in the Southern States to a peculiar pea-green, and this type among others in an orchard can be detected with ease by this means alone. The color of the foliage foreshadows the color of fruit, as none of the seedlings, as a rule, are highly colored. The parent came from China, and it is adapted to zones farther north than those suited to the Spanish.

V.—*Persian race.*—Tree medium size to large; limbs short and thick, with long, naked places; bark usually rich purplish red on young wood: flowers large or small in different varieties; foliage crimpled and conduplicate, with purplish tinge before falling, which happens early. This race requires a long period of rest, which indicates that it has had a more northern origin than any other, supposed to have been Persian. The seedlings now form the bulk of Northern peach orchards. Fruit usually the most highly colored and of the finest flavor. In this race we sometimes find a variety with yellow flesh, but the flavor is not as good as the others. It is almost useless to plant this race in the southern part of the Gulf States.

There are some ornamental varieties which will not be mentioned here.

RECOMMENDATIONS.

In view of the importance of this classification to successful peach culture in the United States, I wish to make the following recommendations for the consideration of this body:

(1) That a committee of three be appointed to be known as a committee on cooperative work in testing the different races of peaches.

(2) This committee of horticulturists shall consist of one man from one Northern station, one from one Central station, and one from one Southern station.

(3) The work of the committee shall be to find out as far as possible the isotherm in which each race is best adapted.

(4) The committee shall recommend to as many stations as may be thought necessary a list of varieties from the different races, to test and report upon.

(5) The committee shall make out suitable blanks to be printed by the United States Department of Agriculture and to be distributed by this Department to the stations desiring to cooperate in the work.

(6) Each station will be asked to pay for its own trees.

(7) The results of this work will be written up by the committee, and after approval by this Association will be published by the United States Department of Agriculture.

After the reading of the paper the recommendations with which it concludes were referred to a committee consisting of E. S. Goff, S. C. Mason, and W. M. Munson. The recommendation of this committee was that the following-named gentlemen be made a permanent committee to carry on the cooperative work of testing the several races of peaches in the various sections of the United States: R. H. Price, of Texas; E. J. Wickson, of California; G. H. Powell, of Delaware, and L. R. Taft, of Michigan.

A paper entitled "Horticultural education in Minnesota" was read by S. B. Green, of Minnesota. As an introduction to his remarks, the author detailed the limitations of the horticulturist in the Northwest by giving a list of the fruits of merit in the State of Minnesota. This served to bring out the peculiarities of the field, and to emphasize the fact that the experience of the East, or the Pacific Coast even, is of little use to the horticulturist in the North Central United States. The solution of these problems is through independent, original work. The portion of the paper dealing more specifically with the question of horticultural education is as follows:

Horticultural Education in Minnesota.

The State Horticultural Society, which was founded in 1866, is the oldest agricultural society in the State. It has published an annual report since 1873, and at present has an annual paid membership of about 500, which, I think, is about the largest of any similar society in this country. It has issued a monthly magazine, called the Minnesota Horticulturist, for four years, and this alone is doing considerable to increase an interest in and knowledge of horticulture. The society has an office in Minneapolis, a paid secretary, and is in every way an active and influential educational force, working in perfect harmony with the State University.

The Farmers' Institute has been organized under its present leader for about ten years. It is liberally supported by the State, and is accomplishing very much in disseminating agricultural education of a popular kind among the people of the State. One member of the institute is a good practical horticulturist, and talks on his theme at every meeting. The attendance at these meetings of the institute is very large, and the farmers are enthusiastic in its support. This force also works in harmony with the university and might be said to represent a most popular form of university extension work.

The plan and scope of the work of the School of Agriculture of the University of Minnesota has so often been referred to that I need here to consider only the work done by it in horticulture. It is located at University Farm, which is equipped with a good nursery, orchards, a forest plantation, and a large collection of species and varieties of timber and ornamental trees, shrubs, and herbaceous perennials. In the garden are grown the standard varieties and novelties in small fruits and vegetables. In all, there are about 35 acres of land devoted to the division of horticulture. We have a good greenhouse, but it is much too small for the instructional work that is needed. In other ways the division is fairly well equipped, although the facilities are very much crowded. The classes in horticulture in the school include about seventy students each term.

The school course is comprised in three school years of six months each. The C, or first-year class, takes up botany in place of horticulture daily for one year. During the fall term the B, or second-year class, takes up the subject of fruit growing, using a small text-book, entitled "Amateur Fruit Growing," that was prepared especially for this class. It considers, in a practical and simple way, the propagation and growing of various fruits that are cultivated in this State. It may be of interest in this connection to note that this book of 137 closely printed pages, which is for local use chiefly, was printed without expense by publishing the copy set one and one-half columns wide in one of the agricultural journals, which paged and electrotyped it for the use of the copy. We find that most of the students who come here for instruction are not sufficiently advanced to take satisfactory notes on lectures, and we must either use text-books or furnish copies of lectures given in order to get satisfactory work. In the study of fruit growing the students are given practical instruction and illustrations in the field as well as in the class room.

In the spring term of the second school year the subject of vegetable gardening is taken up. For this purpose we have a text-book that here answers the purpose very well. We commence this subject by taking up in order the soil, tillage, land best adapted to general crops, manures and their use, irrigation, transplanting, seed sowing, hotbeds, and, later in the term, the study of the various crops in detail. For this purpose the hand and horse garden cultivators are brought in one day and the special potato machinery at another time.

The subject of forestry is taught the first term of the third school year. It consists in the study of the various timber and ornamental trees in the field as well as the class room, in order to familiarize the students with their peculiarities, that they may be able to distinguish them. It also embraces the study of their value for various purposes, such as wind-breaks, shelter belts, street trees, and the value of the wood for fuel, timber, and other purposes. This part of the subject is taught at the opening of the fall term, when the weather is still mild, so that many lessons may be taken in the field. Not only the trees on the grounds of the experiment station are studied, but excursions are made to nearby nurseries and lessons are given in planting trees and cuttings. The latter part of the term is given to the study of forestry physics, the natural distribution of seeds, the care and management of tree seeds, the raising of seedlings, and the laying out of grounds about the home. We have no text-book that is suited for use in this section, and so use mimeographed notes on the subject, illustrated by printed figures.

Greenhouse laboratory work is taken up during the winter term of this year. Two periods per week in the greenhouse and one in the lecture room are required. The first two exercises consist of the testing of a variety of farm and garden seeds. The third exercise is in budding, for which purpose we have used roses and abutilons. Each student practices on willow shoots until he shows reasonable proficiency before he is allowed to work the growing stocks. He then puts in six buds.

The fourth exercise is in the growing of plants from soft-wood cuttings. A variety of plants are used and the cuttings are made from the various parts of the plant and put into the cutting bench.

The fifth exercise is in seed sowing. Each student sows several kinds of seeds after preparing the soil for the purpose.

The sixth exercise consists in the pollination of primulas and in the study of results.

The seventh and eighth exercises are taken up with the various forms of grafting. The students practice on willow twigs until a reasonable degree of proficiency has been attained, and then use seedling apple roots. The grafts are at once started into growth and later are examined to see how the parts are united.

The ninth exercise consists in the pricking out one or two boxes of very small seedlings.

The tenth and eleventh exercises are in potting the cuttings that were put in the early part of the term, mixing potting soil, and in repotting.

The twelfth exercise is the study of the hotbed and its management. A greenhouse hotbed is started in February of each year for illustration and other purposes.

During this term visits are made to the large floral and vegetable greenhouses near by. The class room exercises consist of lectures and recitations on the work being done in the greenhouse. A talk is always given previous to doing the greenhouse work, and special attention is paid to the application of these lessons to the growing of plants about the home. We also find time for some study of the conditions under which plants improve most rapidly, and use a part of Bailey's Plant Breeding as a text-book. An outline of each laboratory exercise is mimeographed, and students are furnished with one copy each.

In all subjects written tests are given, about once in two weeks, and reports on the laboratory work are required from time to time.

In addition to the instruction outlined, the stereopticon is used winter evenings to illustrate some of the different phases in the development of horticulture in this section.

The college course in horticulture is a continuation of the work done by the school of agriculture. It embraces practical work in the propagation of plants; general nursery management; in the crossing and hybridization of plants; the growing of fruits, vegetables, and flowers for market; the care and management of the various hardy ornamental trees, shrubs, herbs, and summer bedding plants; the laying out and planting of lawns and parks; and the study of the evolution of horticultural plants.

The subject of seed testing was reported on by the committee, and the rules governing this work as formulated by them were adopted by the section (see p. 00).

Two papers were recommended to the executive committee to be read in general session: (1) "An experiment; its conception and execution," by H. L. Bolley, of North Dakota; and (2) "A bacterial disease of cabbage and allied plants," by H. L. Russell, of Wisconsin. For lack of time only the first was presented in general session (see p. 47). The second is as follows:

A Bacterial Disease of Cabbage and Allied Plants.

At the Springfield meeting of the American Association for the Advancement of Science, in 1895, a brief report was made by the writer on a bacterial disease of cabbage that had not previously been noted. In the following year the opportunity presented itself for a more extended study of the problem, and while our experiments are not yet entirely complete in all their details it has been deemed wise to report to this Association a brief summary of our present knowledge, inasmuch as the etiology of the disease is now conclusively demonstrated.

HISTORY OF THE DISEASE.

This disease first came to our notice in 1895, when a casual examination showed that it was evidently a bacteriosis. The garden patch of cabbage that was found affected at this time was not seriously injured, and a study of the disease was taken up more on account of its relation to bacteria than from an economic aspect. Culture experiments made from the diseased tissue at this time showed two predominant organisms. Artificial infection experiments were made, but the cabbage plants at hand were so nearly matured that these infection experiments were not of a decisive character.

The disease appeared again in the fall of 1896 in the experimental plats of cauliflower at the Wisconsin Agricultural Experiment Station. Attempts were again made at this time to isolate the causal organism, and as a result of these a bacillus producing a yellow pigment on culture media was isolated in large numbers. Soon after this we received from Dr. J. J. Davis, of Racine, Wis., specimens of cabbage that were similarly affected. From this material there was separated a bacillus having the same general characteristics as that isolated from the material found at Madison.

In the neighborhood of Racine, in 1896, the disease assumed a very severe phase, causing a destructive rot that often destroyed the entire crop in fields of considerable size. In that vicinity alone the loss last year exceeded $50,000, and the industry in this region was severely threatened. According to information elicited from growers in that vicinity, the disease is one of recent introduction, having first made its appearance in about 1890. For two or three seasons after this nothing further was heard from the same, but in 1893 it again broke out, and several acres of cabbages were partially destroyed. The disease continued to spread gradually until in

1895 nearly half of the acreage in this region was more or less severely affected, and last season, 1896, the loss was the worst of any year. At the present time the disease is beginning to show itself to a slight extent, but as it develops mainly in late summer it is impossible to foretell what the outcome of it will be the present year.

From correspondents, and from examination of districts where cabbages are grown in various sections of the State, it is evident that the disease is already quite widespread, it being reported in eight or ten different counties of this State. Correspondence with various botanists has revealed the fact that it is also more or less serious in other sections of the country. Professor Pammel writes that it bothers to a considerable extent in Iowa. Professor Garman, of Kentucky, says that it occurs quite frequently in that State and other Southern States. Professor Stewart, of the Long Island branch of the New York State Experiment Station, reports it as widespread in that State, as does also Professor Jones of the Vermont Station.

SYMPTOMS OF THE DISEASE IN THE FIELD.

Usually the disease does not make its appearance until the season is well advanced. Its development is largely dependent upon climatic conditions; and in a wet season especially, if accompanied with high temperature, the trouble manifests itself earlier and assumes a more serious aspect.

Early stages.—Usually the disease makes its first appearance on the margins of the leaf in proximity to some of the blunt teeth in which the finer veinlets terminate. The first appearance is characterized by a yellowing or blackening of the leaf in the vicinity of this spot, and if the leaf is viewed by transmitted light the veins appear black or brown, instead of translucent as in a healthy state. This affection of the fibro-vascular tissue cuts off the water supply of the plant, and soon causes death of the cells of the leaf. This dead tissue turns brown and dries out, becoming parchment like in texture. As the disease works its way down the leaf, the affected area gradually increases until finally it reaches the midrib and petiole of the leaf.

Advanced stages.—In this way the disease gains a foothold in the stem of the plant, and from there it spreads more or less rapidly throughout the entire plant. The disease is distributed in the plant by working its way through these fibro-vascular strands. As the cabbage head is formed, the specific organism is able to penetrate the interior of the head in this way. The result of this is to cause a destructive rot in the head itself, thus injuring the commercial value of the crop. The losses that occur in cabbage held in storage are considerable, and last year a quarter of the stored crop in the Racine district was lost through the development of this disease in the stock.

A close examination of the cut end of the stem will show whether the disease has already worked its way into the head of the plant. This can generally be told by the blackened fibro-vascular bundles, which may show only a single speck, but, however small, such a head should be rejected for storage, as the disease will almost invariably develop in the head during the time that it is held in storage in the winter.

In addition to this disease there are other maladies of cabbage and cauliflower that are produced by bacteria that must not be confused with this affection in the bundle system. A very destructive, wet, stinking rot often consumes the entire head and is of frequent occurrence. In many cases this attacks healthy, vigorous plants, and, in some instances, it appears as a sequel to the disease here described. Then, too, there is a fungus disease of cabbage, called the cabbage rust, that produces an appearance that is often confused by the growers with the bacterial rot here described.

CAUSE OF THE DISEASE.

Among the growers and dealers of cabbage there is no definite opinion as to the cause of this trouble. The different explanations that have been given from time to time are really nothing but surmises based on very meager data. Some incline to the view that the rot only occurs in plants whose vitality is first reduced by the attack of the cabbage maggot. The most widely accepted notion is that the trouble is due to imperfect seed. The writer succeeded, in 1895, in isolating from diseased tissue the two bacterial organisms heretofore reported, but infection experiments were not decisive. In the summer of 1896 the yellow pigment-forming bacillus was separated in pure culture, and, as this was one of the organisms found the previous year, it seemed highly probable that it was the cause of the disease. This same species was found in cabbage and cauliflower that came from six or seven different localities, and its constant association with the disease indicated that it was undoubtedly the causal germ. Infection experiments were then made in healthy young cabbage and cauliflower grown in the greenhouse. The introduction of the organism was made by puncturing the leaf or stem with an infected needle. The method of infection was varied in a number of particulars. In some cases it was first treated with an antiseptic solution and then, after inoculation, the wound was closed with sterilized grafting wax or vaseline. In other cases the healthy plant stem was inoculated

without any previous treatment. Coincident with this artificial inoculation with an infected needle, other check plants were also stabbed with a sterilized but uninfected instrument.

The result of these inoculation experiments with the yellow organism was successful in hundreds of cases with but a single exception. If the disease germ was introduced into the base of the petiole of the leaf, the disease manifested itself in the course of a week or ten days, the blade usually showing the first indication of the trouble. The rapidity with which it spread through the tissue was subject to considerable fluctuation, but the appearance of the inoculated plant left no doubt as to the pathogenicity of the germ in question. In many instances the inroads made by the attacking organism were so severe that death of the plant ensued.

From these artificially infected plants the same specific disease organism was again isolated in pure culture, showing conclusively that this was the cause of the disease.

In this connection it will not be necessary to give a full history of the germ in question, as this is being worked out more in detail for a later publication.

The organism grows luxuriantly at ordinary temperatures, but fails to develop as rapidly at blood heat. On artificial media it thrives luxuriantly, especially on agar and potato. On the latter culture medium growth is very abundant and continues to develop for a long period, forming a yellow layer of considerable thickness, that gradually deepens in intensity, and increases to such an extent that the entire surface of the potato is covered with a brownish honey-like mass. The organism fails to grow under anaerobic conditions, no growth occurring in the closed arm of a fermentation tube.

A comparative study of this germ with forms already described shows that it has a number of characters that agree with Pammel's *Bacillus campestris*, the cause of the ruta-baga rot.[1] Pammel found his organism in rotting ruta-bagas, and succeeded in producing the disease by artificial inoculations in ruta-bagas and yellow turnips, but made no further trials on other species of the genus Brassica. Furthermore, he says his organism is a nonliquefier of gelatin, while the cabbage bacillus is able to liquefy gelatin, although liquefaction does not show for some time. Pammel's description is so brief and incomplete that the biology of the germ and its relation to different host plants should be worked out more fully. The forthcoming report of the Wisconsin Agricultural Experiment Station will contain a full account of all of these relations.

RELATIVE SUSCEPTIBILITY OF DIFFERENT HOST PLANTS.

So far inoculation experiments have failed on other plants than those belonging to the genus Brassica, and even within the limits of the different species of this group there is a varying susceptibility. From the data already at hand the following order of natural susceptibility of different host plants may be given.

Cauliflower seems to be most susceptible, frequently succumbing under conditions where cabbage shows only a mere trace of the disease. Cabbage is, however, readily affected, if the climatic conditions are favorable. The other varieties closely related to cabbage and cauliflower, such as kale, broccoli, kohl-rabi and Brussels sprouts are quite susceptible to the disease, acquiring it by natural means. Collards seem to be the least susceptible of any closely related variety. Turnips, ruta-bagas and winter radishes are in our experience only slightly susceptible. Since the disease came under our notice two years ago, we have never observed these latter crops affected by the operation of natural causes. However, when the organism is artificially introduced into many of the horticultural varieties of the genus Brassica, it is able to live and develop. It is, however, much more pathogenic for cabbages and its congeners than it is for ruta-bagas and turnips.

MODES OF ENTERING THE PLANT.

The manner in which the disease is spread and the method by which it gains access to the plant are questions of practical importance, concerning which we have gained some definite information.

An examination of the diseased plant in its earliest stages will show two methods by which the disease germ obtains a foothold. One is by entering the leaf where the tissue has been chewed or eaten by insects. Sometimes the smaller veinlets are eaten off, and where such is the case no doubt infection can readily occur, although this method of introduction is very much less common than the other, which is by entering the water pores that are present on the margin of the leaves.

These water pores are situated on the blunt teeth in which the finer veinlets terminate, and a close inspection of a diseased plant at an early date will show that the infective material was introduced at this point.

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[1] Iowa Sta. Bul. 27, pp. 130–134.

The manner in which the disease germ is able to work its way into the uninjured plant through this water pore is interesting. Under natural conditions the disease makes greater headway during the late summer and fall of the year. At this time the formation of droplets of water at these water pores takes place much more frequently than at other periods. This is due to the fact that the temperature during this period is reduced, especially during the night, and therefore the air is often nearly saturated with moisture. Under these conditions the water, which is usually thrown off by the plant in a state of vapor, is now condensed and gathers in tiny droplets at this point. These water beads persist for some hours, especially if the air is nearly saturated; and if the disease germs are floating in the air, they may be caught in these water drops. Culture experiments have been made in these expressed water drops, and it has been found that the cabbage germ is capable of growing therein. Under these conditions, it is evident that infection occurs in this way. The proof of this theory was further demonstrated by artificially inoculating a large number of these water drops with a culture of *Bacillus campestris*. In the course of two or three weeks the disease became apparent at the point of inoculation, and the trouble progressed rapidly down the veinlet until it became thoroughly established throughout the plant.

SOURCES OF INFECTION.

The disease germ is able to winter over in the soil, as has been determined by experiment, and therefore infected fields, if planted to cabbage on successive years, are liable to transmit the contagion from year to year. In the majority of instances the disease germs are distributed by means of the wind, the germs either being blown from the superficial layers of the soil or from plants which have been previously infected in some way and which are dying in the fields. Frequently one observes around a prematurely diseased plant a large number of other plants that have subsequently acquired the infection, showing that close proximity to diseased plants is a fruitful source of infection.

INFLUENCE OF CLIMATIC CONDITIONS.

The disease under natural conditions is subject to considerable variation in regard to its severity. Even on the same soil, where cabbage is planted year after year, a severe attack of the disease is often followed by a much lighter epidemic. The reason for this is not so much in the varying number of the specific bacteria in the soil, as it is the climatic conditions that are incident to the various seasons. In warm wet weather the disease progresses very much more rapidly than during a dry season. Not only are plants more susceptible in periods accompanied with an excessive rainfall, owing to the more frequent formation of water beads on the leaves, but the course of the development of the disease in the plant itself is much more rapid in warm weather than during a cold dry season. In fact, conditions which favor the most rapid development of the host plant are conditions that also hasten the rapidity of the spread of the disease within the tissues. This is readily demonstrated where plants are irrigated with large quantities of water. During the past year experiments have been carried on in the greenhouse and also under field conditions which demonstrate that a rapid succulent growth is more favorable to the spread of the disease than where the plant develops less luxuriantly.

REMEDIAL MEASURES.

Attempts toward remedial measures against a bacterial disease are not usually successful, owing to the fact that such diseases develop as a rule entirely within the plant tissue, and unless the disease germ can be prevented from gaining a foothold in the plant nothing but general measures can be suggested.

Undoubtedly by rotation of crops and removal of diseased débris the specific organism would be greatly reduced, but it is quite problematical whether such measures would be effective enough to be of practical value.

One restrictive measure suggests itself that would seem to offer a solution to the problem, and that is the removal of incipiently diseased leaves before the trouble has established itself in the stem of the plant. The manner in which the plant becomes diseased permits of an early recognition of the trouble, and if a leaf is removed before the disease bacteria have worked their way down into the midrib and from there into the stem, it is possible to prevent further infection from this source.

In case plants should be diseased in the main stem they should be pulled up entire, and, together with all diseased tissues, removed from the field, as the dying plants are very frequently the sources from which contagious matter is spread throughout the fields.

Experiments of this character are now in progress, and there is every evidence to indicate that this will afford a certain relatively cheap way of combating the disease.

SECTION ON ENTOMOLOGY.

At the session of the Section on Entomology only two persons were present, and these simply went through the form of holding the meeting and nominating officers. The following papers were read by title: "Teaching entomology," by E. E. Bogue, of Oklahoma; "The Western pine butterfly," by J. M. Aldrich, of Idaho; and "*Aspidiotus perniciosus* in North Carolina," by G. McCarthy, of North Carolina.

SECTION ON MECHANIC ARTS.

The first meeting of the Section on Mechanic Arts was held in the library building of the University of Minnesota and was called to order at 2 p. m., July 13, by Chairman Murkland, of New Hampshire.

The first paper presented was by J. Jensen, of Utah, as follows:

Development of Electric Engineering in Utah.

The State of Utah possesses wonderful facilities for the generation and utilization of mechanical power. Much has been said and written of the natural resources of Utah, especially of the utilization of her mountain streams for irrigating purposes; but so far as the writer knows no effort has been made to describe the vast amount of available power which they represent. In order to convey some rough estimate of the extent of the power practically available from these streams it must be borne in mind that Utah is essentially a land of high mountain ridges with valleys between. These ridges range from 3,000 to 5,000 feet above the valleys; their sides are cut by great gorges or canyons, ranging from 10 to 30 miles in length. Vast deposits of snow fall on these mountain ranges during the winter months, which pass in great watery floods during the early summer months and in more contracted streams throughout the remaining part of the year to the valleys below. Thus Utah becomes a land of streams as well as a land of mountains. These streams vary in size from an average flow of 4,000 or 5,000 second-feet to the rippling brooklet too small to be considered for power purposes. Perhaps the best estimate of the power thus available will be obtained by examining a little more carefully the water flow of a single valley. Cache Valley, situated in the northern part of the State and extending across the line into Idaho, affords the best example. This valley is about 40 miles long by 12 miles average width. All of its streams flow from the east range of mountains into Bear River, which cuts through the mountain range on the west. The flow of these streams was carefully measured during the summer of 1896 by Professor Fortier, hydraulic engineer to the Utah Agricultural College Experiment Station. The following table shows the maximum, minimum, and average flow, from June 15 to September 15, of the five streams whose flow might be considered sufficient for power purposes. The figures are computed from the measurements of Professor Fortier as detailed in Utah Station Bul. 50.

Flow of five Utah streams from June 15 to September 15, 1896.

Name of stream.	Maximum flow, in second-feet.	Minimum flow, in second-feet.	Average flow, in second-feet.
Logan River	1,600	300	640
Blacksmith Fork River	350	175	221
Cub River	500	60	186
East Fork Little Bear River	120	25	51
South Fork Little Bear River	250	35	65

Total average flow, in second-feet, 1,163.

A careful study of the tables of water flow in the streams of this region of country, given in reports of the United States Geological Survey, shows that the annual average flow is somewhere near one-third the maximum flow. Applying this rule to the streams of Cache Valley, we get, roughly, an average flow of 1,000 second-feet. By conducting this water along the hydraulic gradient from a point just below the confluence of the chief tributaries to a point just above the head of the irrigating

system, a distance on the average of about 8 miles, it is fair to assume that a head of 800 feet will be obtained. A simple calculation shows that this means for Cache County over 90,000 horsepower.

This power comes naturally with a rythmical flow, as already observed, though the flow may readily be rendered practically uniform by a regulating reservoir, which can nowhere be built at a less expense than in these mountain gorges, since by properly locating the site a dam across the gorge of 400 or 500 feet width will serve to impound millions and even billions of gallons of water.

A glance at the map of Utah will show that Cache Valley is only one of upward of a score in the State, and that each presents similar advantages for hydraulic power.

Then it appears that a million horsepower as an estimate for the total available hydraulic power of the State is a very conservative figure. Hitherto only a very small part of this power has been used, and then in small isolated plants directly applied, in the mountains for lumbering, and for flouring in the valleys. Nor, indeed, has it been available for power purposes, since it has largely been appropriated for irrigation by prior claim; and it has been impracticable to locate power-using industries above the head of the irrigation systems. It is apparent, therefore, that a direct application of this power is not to be looked for. It has, therefore, only been since the accomplishment of long-distance transmission of power electrically that this energy has become available for power purposes. The irrigation problem no longer interferes with a free use of all this water for performing mechanical work. By locating the power plant above the head of the irrigation system the water can be made to turn the electric generator and then continue on its course undiminished, and do service for the farmer as before, while the energy obtained from it may be transmitted to the valley, or even to the more remote centers of industry, and there serve its purposes.

The nature of the case determines the general character of the plant. That is a long aqueduct, preferably a pipe, connected with a regulating reservoir formed by a suitably located dam across a mountain gorge, and provided with ample and efficient means for governing the water flow; at the other end a large hydraulic motor, necessarily of the impulse type, directly connected multiphase alternators, and a high-pressure transmission line, with suitable transformation apparatus at either end.

Enterprising investors have not been slow to recognize these advantages. During the last four or five years upward of $2,000,000 have been devoted to the building of just such plants as above outlined, and as a result Utah leads the entire West in the development of electric-power plants, while, if individual plants be considered, she stands second to Niagara alone; but in the unique features of these plants it is only fair to say she leads the world.

This may seem a very sweeping statement, and it requires to be corroborated by a description of some of these features somewhat more in detail.

The largest operating plant of Utah to-day is that of the Pioneer Electric Power Company. It is located on the Ogden River, its power house being within the city limits of Ogden. According to the reports of the United States Geological Survey for 1890, the average flow of the Ogden River was 765 second-feet, varying from 2,100 second-feet as a maximum, in May, to 200 second-feet as a minimum, in September. This water is diverted from its natural channel, for the use of the power company, nearly 7 miles above the power house into an immense tube 6 feet inside diameter. The upper end of this aqueduct is built of staves 2 by 7½ inches, of Oregon fir. This lumber has been so carefully selected that the inspector searches in vain for a knot or a wind shake. By running the staves through a template in an especially prepared planer they have been given a form corresponding to the contour of the tube, which then becomes perfectly circular both inside and out. The 32 staves required to complete the circumference of the tube are held firmly together by means of rod-steel bands from five-eighths to three-fourths of an inch in diameter. These bands are made in two sections, each forming a semicircle, with an eye at one end and a screw thread at the other. The two parts are held together by means of a cast-steel saddle, with provisions for tightening the band by means of a nut. They are spaced from 2½ to 4 inches apart, according to the pressure in the tube. This tube is 26,869 feet long, is built for the most part in a trench on the side of the mountain and covered over. It spans several gulches of varying depths and widths on steel trusses, and passes through seven tunnels cut through the solid rock, the largest being 650 feet. In its course it follows largely the convoluted form of the mountain side, having several rises above the hydraulic grade; its pressure has been kept within the 100-foot limit. At each summit of a vertical bend is an air tube to prevent air locks. The material used for this part of the duct is as follows:

One million six hundred thousand feet of lumber, 78,000 bands, containing 2,400,000 pounds of steel.

Just at the point of the mountain where the slope begins to increase a steel tube is substituted for the wooden tube. This tube is made from rolled steel plates 19 by $9\frac{2}{12}$ feet, and varying from three-eighths to seven-eighths of an inch in thickness.

These were rolled into cylindrical shells 6 feet inside diameter, and riveted with double-strap butt joints; each section has then been thoroughly coated by repeated dipping with asphaltum; the sections are joined in position by a single-strap butt joint. All riveting was done by specially constructed machinery. There are 479 sections of this tube with 14 elbows, giving a total length of 4,570 feet, or a total length of steel pipe and wooden pipe of 31,439 feet (approximately 6 miles). Total weight of steel pipe is 1,630,000 pounds. Its static pressure at the upper end is 100 feet (43.5 pounds per square inch). It is anchored in position by means of several great masses of concrete, built around the pipe, weighing from 100 to 150 tons each. All elbows are similarly secured. Near the upper end of the steel pipe is placed a gate, operated, by means of an hydraulic lift, directly from the power house, more than three-fourths of a mile away. Thus, in case of injury or accident to the machinery or to the pipe below, the water can immediately be shut off at this point. In order to prevent water ram, and consequently excessive pressure on the pipe above, a vent pipe has been inserted, running up to a static grade. The entire length of the pipe has been provided with manholes at short intervals, so that every part of the pipe may be subject to inspection. From the end of this steel pipe run two smaller steel pipes, 54 inches diameter, to the receivers on each side of the power house. These pipes and receivers are of similar construction to that of the main steel pipe. The receivers are 6 feet inside diameter, 97 feet long, made of seven-eighths-inch steel plate. In each of the small pipes is a Venturi meter, connected with a dial indicator in the power house, from which the flow may be read at any time. A 48-inch gate is also placed in each of the small pipes, by means of which the water may be turned all one way when desired. Five service pipes, tapering from 30 to 16 inches diameter, lead from each receiver to a 6-orificed nozzle. Each service pipe is provided with two gates, one to be operated by hand, the other operated from the switch board by means of an hydraulic cylinder and piston. The nozzles are provided with a slide-valve gate, similarly operated from the switch board. Each of the six orifices of the nozzle is $2\frac{1}{16}$ by $3\frac{1}{2}$ inches; from these orifices the water impinges, with a velocity of about 12,000 feet per minute, upon the vanes of Knight & Company's water motor. It falls from the water motor into a large subterranean channel running under the center of the power house through its entire length, and thence to the river bed, about three-fifths of a mile away, to be used for irrigation purposes.

The water motors are of the impulse type, quite similar to the well-known Pelton motor. They are 58 inches in diameter, provided with a heavy fly wheel on each side, and run, under normal pressure, with a speed of 300 revolutions per minute. Upon the same base, and driven by an insulated shaft coupling, stand the large 750-kilowatt (1,000 horsepower) General Electric Company alternators. These are of the 3-phase 60-cycle type, 24 poles, armatures tapped at three points. The three conducting cables from the three poles or collector rings are collected into the same sheath, then pass, through a hole in the cement floor, into an underground passage, which extends entirely around the room, and thence to the switch board, which is a most excellent example of the electrician's art. The board itself is made of highly polished marble—a panel devoted to each machine. The front of each panel represents a complete set of electrical measuring apparatus and the levers and cranks for the regulation of the water gates. Each machine is further supplied with hydraulic-pressure gauge and tachometer. The back of the board presents the conductors, which consist of bare copper strips one-fourth by 2 inches. These strips are collected into a single circuit at the two middle panels of the switch board, which again present a full set of measuring apparatus for the measurement of the collected current. From here the current is conducted to the large 250-kilowatt transformers overhead, of which there are 9 in number, and the potential raised from 2,300 to 16,100 volts for the transmission line after communicating with the high-pressure distribution board. There are two circuits, of 3 bare copper wires each, extending to Salt Lake City, a distance of 38 miles. At the present electrical pressure this line has a capacity for transmitting 3,000 horsepower. It is the intention of the company to change the connections of the transformers so as to raise the transmission voltage to 24,000, and thus greatly increase the capacity of the line.

The excitation for the generators comes from two 6-pole 100-kilowatt dynamos. Each of these has a capacity for exciting the full installment of alternators for the development of 10,000 horsepower. Power is taken direct from the excitors to run the company's private and well-equipped repair shop, about 100 feet away. Five out of the ten individual plants, i. e., water wheels and connected electric generators, are already installed and doing service. Besides the machinery already described, the 46 by 135 feet steel and brick building is provided with a 15-ton traveling crane, spanning the whole width of the room and traveling its entire length. This makes it possible to pick up one of the entire plants and move it to any part of the room desired with perfect safety and with comparative ease. The part of the plan of this company yet to be completed is the installment of five other plants in the power house, and the construction of a gigantic dam for the impounding of water during

the spring and early summer flood, to be used when the natural supply becomes small. The site selected for this dam is about 6 miles above the power house. The gorge at this point is less than 40 feet wide. Massive cliffs project on either side to serve as natural abutments; about 35 feet excavation uncovers the bedrock. It is proposed to build the dam with concrete piers running parallel to the direction of the stream, near enough together and of sufficient depth longitudinally to hold back the water, so that the filling material will not be depended upon for resisting any of the water pressure. This masonry structure will be made absolutely impervious by means of a covering of steel plate at the back, one-fourth of an inch thick. The dam will be about 60 feet high above the present water level, 100 feet deep at the base, 20 feet at the top. This will serve to inundate upwards of 2,000 acres of land and to impound 15,000,000,000 gallons of water.

Perhaps it will not now seem quite so extravagant to remark that in these unique features in the development of electric engineering Utah leads the world. The estimated cost of this plant when completed is $1,500,000, two-thirds of which has already been expended.

But this is not an isolated case. Only about 60 miles south, in Big Cottonwood Canyon, is the plant of the Big Cottonwood Power Company in full working operation, and really precedes the Pioneer Company in priority of date.

The general features of this plant are very similar to those of the Pioneer Company's plant. Its reservoir is already built. It is located in a natural pocket in the canyon, being bounded on all sides by high projecting cliffs, excepting a narrow cut through which the river made its escape. Sufficient clayey soil and gravel was found in the bottom of this pocket to build an embankment 535 feet long, 92 to 135 feet wide at the base, 19 to 31 feet high and 24 feet wide on top. The embankment was riprapped on the front and part of the back with rock. Insecure as this kind of a dam would seem, especially for a high dam, the one in point seems perfectly safe and is almost impervious. The small amount of leakage seems to be rather from the bottom of the reservoir than through the dam itself. When the writer visited the site, about three weeks since, preparations were being made to puddle the bottom by washing soil down from the mountain side with a force pump and nozzle, operated by a 10-horsepower motor. The reservoir covers nearly 9 acres of land to a depth of from 10 to 35 feet. This reservoir has been built rather as a provision for an emergency than as a necessity, as it is rarely the case that the natural flow of water is less than the demands for power. Extra water in the river is taken care of by means of a tunnel around the end of the dam through the solid rock, 180 feet long, 6½ feet square, provided with suitable regulating apparatus, and also by means of a 30-foot weir over the top of the dam.

The aqueduct from the intake runs through a 430-foot tunnel cut in quartzite and slate. The duct consists of a 50-inch-in-diameter tube, 1,420 of wood and 2,300 feet of steel, built on the same plan as that of the Pioneer Company's already described, except that the sections of the steel pipe are joined by a wrought-iron flange joint instead of a lap-butt joint. The bands on the wood pipe are made of a single rod, threaded on either end and secured by passing through a cast-iron lug and nut. In the short distance of about 3,500 feet is secured a static head of 380 feet. Inside the power house we find four generating plants of the same character as those already referred to, except that the Pelton motor is used instead of the Knight, and the alternators are each 750 horsepower instead of 1,000. They are made by the same company and are of the same class. The voltage is raised from 550 to 10,500 for the transmission line. Four complete circuits leave the power house, consisting of three wires each. The power is used in Salt Lake City, 14 miles distant, and at the Murray smelters, 12 miles distant.

In the same canyon, only about a mile below, is the plant of the Utah Power Company, with a capacity of 750 horsepower, also transmitting to Salt Lake City. At Logan we have the Hercules Company, with a capacity for 1,000 horsepower, used for power and lighting in Logan. Besides this the State is sprinkled with small lighting plants.

The building of another 10,000-horsepower plant is being rapidly pushed by the Telluride Company in Provo Canyon, about 50 miles south of Salt Lake City. It has already built its flume for a temporary plant to be used in the construction of the permanent plant. It has located and begun operations on a dam, the site of which possesses all the advantages that these mountain regions afford for the impounding of water. This dam will be about 85 feet high and impound enough water to secure a steady flow in excess of the demand for the generation of 10,000 electrical horsepower. It is the object of this company especially to supply the mining districts of Eureka, 50 miles; Mercur, 30 miles, and Park City, 30 miles away. It is probable that a line will also be run into Salt Lake City. It is expected that the permanent plant will be ready for operation in about two years.

It is just now rumored that two other large companies have been organized, one to operate at the Jordan Narrows, a few miles south of Salt Lake, and the other on the Sevier River in the southern part of the State.

Taking into account, in connection with these developments of power, the re-

sources of iron, lead, copper, asphaltum, salt, gypsum, coal, and other mineral products; of wool and hides; of fruit and grain; and also the consumption of the manufactured articles from these materials, it seems to be an obvious conclusion that Utah is destined in the near future to become one of the greatest industrial centers of our country.

The paper called forth a very interesting discussion, which was taken part in by J. M. Tanner, of Utah; J. H. Canfield, of Ohio; O. Clute, of Florida, and W. S. Aldrich, of West Virginia. The discussion by W. S. Aldrich brought before the section the Hale bill, which received a great deal of attention. President Canfield was very anxious to see the bill pushed through, and that every effort should be made to get a direct appropriation. He was very much in sympathy with the movement to have each State do a specific line of work, which would be of direct value to her people. He was opposed to doing scientific work simply for science sake.

J. H. Canfield moved to prepare a statement of the sense of the Section on Mechanic Arts with reference to the engineering experiment station bill.

A. J. Wiechardt moved that a committee of three be appointed to determine and propose means that will promote a greater interest in the Section on Mechanic Arts, to report at the next convention. A. J. Wiechardt, C. R. Richards, and W. S. Aldrich were appointed.

C. R. Richards, of Nebraska, read the following paper:

A Calorimetric Determination of the Heating Value of Corn.

Since man first learned to use fire the subject of fuel supply has been of gradually increasing importance. The progress of civilization is marked by the increase in fuel consumption. Mechanical energy, human power, light—everything—is dependent upon heat, and it becomes necessary to use the available sources of heat intelligently that there may be no useless waste of energy.

In many of the Western States the cost of fuel for manufacturing operations or for domestic use is considerably greater than in any other section of the country possessing an abundant supply of coal. Manufacturers thus find it difficult to compete with other firms that can secure cheap power, while in the household the cost of fuel is a very large item in the yearly expenses. The almost entire absence of a natural fuel supply, together with excessive freight rates and little competition, are largely responsible for this condition.

As is to be expected in a treeless and coalless country, the farmers of the West have used for fuel anything that is available—buffalo and cow chips, hay, straw, cornstalks, cobs, and, lastly, corn itself. This is another illustration of the ability of man to adapt himself to his surroundings and to utilize what he has for what he needs. It is difficult to say at what time corn was first burned, but it has probably been used to a greater or less extent for a good many years. Dire necessity drove the early settlers to this practice, the results being sufficiently good to warrant its continuance.

In a general way it has been recognized by our Western farmers that when corn is abundant and cheap, and coal is expensive, the former makes a cheaper fuel than the latter, although no scientific determination of their relative efficiency has ever been made, so far as the author is aware. During the past winter a number of inquiries were received by the department of agriculture of the University of Nebraska asking for information about the efficiency of corn as fuel. The author undertook the investigation of this subject, and the results of the first tests were published in a press bulletin, issued by the experiment station early in January of the present year.

Later in January the State Board of Transportation of Nebraska addressed a circular letter to grain and coal dealers throughout the State asking for conservative estimates of the number of people in their vicinity who were burning corn. This investigation by the board of transportation was undertaken to secure data for an attempted readjustment of existing freight rates on corn and coal. Many of the replies to these letters are of interest, and the author takes the liberty to quote from some few of them. It would otherwise be difficult to believe that so many of the farmers of Nebraska have used corn for fuel during the past winter.

Quoting from a letter from Battle Creek, Madison County, Nebr.: "The farmers are buying no coal at all. Those who bought coal in the past are now burning corn. My coal trade is now confined to the town and to a few school districts, but this has fallen off 50 per cent since corn touched 10 cents per bushel." From Petersburg, Boone County, Nebr.: "All farmers in this vicinity are using corn for fuel. We sell coal, and our former customers are now burning corn." From Pleasanton, Buffalo County, Nebr.: "At least three-fourths of the people in this section are burning corn." From Rising City, Butler County, Nebr.: "All the farmers are burning corn. They say it is as cheap as coal. Some claim they have burned as much as 200 bushels

already." From Ulysses, Butler County, Nebr.: "We think there will be 15,000 bushels of corn burned in the district tributary to this town, or, in other words, 60 bushels to every quarter section of land." From Meadow Grove, Madison County, Nebr.: "Our farmers are burning corn almost to a man. I don't think I have sold to exceed 5 tons of coal outside of town this winter. Farmers say they can not afford to sell corn for 7 to 9 cents per bushel and buy coal for $7 per ton, that being the price of Rock Springs coal, which is sold here altogether." From Prosser, Adams County, Nebr.: "There is no doubt but that nine-tenths of our farmers are burning corn, and so far as I can see, from a financial standpoint, it is the right thing to do. * * * We are using it in our schoolhouse." Most of the other letters contain essentially the same information as the foregoing.

From the above letters it appears that a large percentage of the people in Nebraska use corn as fuel when the crop is abundant and the price low, and we may naturally infer that the same condition prevails in some of the other Western States. It is an unfortunate fact that in most of the sections where the value of corn is least, the cost of coal is greatest. From a sentimental standpoint, it must be a difficult matter to burn corn, but from an economical standpoint it is merely a question of dollars and cents—a question of the greatest number of heat units for the least expenditure of money.

THE FIRST TESTS.

The earlier tests of corn, previously mentioned, were made to compare the heat of combustion of corn with that of Rock Springs, Wyo., coal, which was thought to be most largely used in Nebraska, especially in the western part.

Two boiler tests were made, the first, an eight-hour test of corn, during which 5,232 pounds were burned; the second, a six-hour test of Rock Springs coal, during which 1,888 pounds were consumed. The results of these boiler trials showed that the coal gave 1.9 times as much heat as the corn.

A good grade of yellow dent corn was used in this test. It had been husked but a short time before, and contained a large amount of moisture, which was not taken into account in the test. No determination of the actual percentage of moisture was made, although it is probable that it was not far from 20 per cent. The Rock Springs coal is an exceedingly free-burning, noncaking, bituminous coal, containing a very small percentage of ash. This coal costs, in Lincoln, $6.65 per ton.

After having completed the boiler trials, samples of the coal and corn were burned in a fuel calorimeter, which will be described later. The heat of combustion of the corn was 7,076 British thermal units,[1] and of the coal, 13,010 British thermal units.[2] The ratio of these results, 1.86, agrees very closely with the ratio obtained in the boiler trials.

These first tests demonstrated that the particular kind of corn used must be worth 12¼ cents per bushel to cost as much as the Rock Springs coal, not including the cost of hauling the corn to market and of returning with the coal.

DESCRIPTION OF THE CALORIMETER USED.

Before giving the results of the second series of tests, a brief description of the calorimeter employed in these trials may be of interest. The calorimeter used is quite simple, being not unlike one devised by Mr. George H. Barrus,[3] or one used by Prof. Robert Smith, of Mason's College, Birmingham.[4]

Briefly described, the calorimeter consists of a bell or bottle shaped glass combustion chamber, 2¾ inches diameter by 4 inches high, whose bottom is open, and whose mouth is closed by a rubber stopper with a small glass tube running through it down about an inch into the bottle. A metallic base may be attached to or detached from the combustion chamber by three spring brass clips. In the center of the base a short piece of brass tubing is soldered, forming a receptacle for a platinum crucible in which the combustion of the sample of fuel takes place. A copper can or jar, about 5 inches diameter by 12 inches high, contains water in which the calorimeter is plunged during combustion.

Two grams of powdered fuel are placed in the crucible, together with a short piece of cotton fuse. The fuse being lighted, the glass combustion chamber is placed on the metallic base, and the whole calorimeter is plunged into the can containing 2,000

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[1] The British thermal unit is the pound-degree, or the amount of heat required to raise a pound of water from 50° to 51° F.

[2] This heat value of Rock Springs coal is a little higher than was found in some tests made at the University of Wyoming by Professors Slosson and Colburn, and published in a special bulletin, entitled "The heating power of Wyoming coal and oil."

[3] A Coal Calorimeter, by G. H. Barrus. Trans. Amer. Soc. Mech. Eng., Vol. XIV, Paper DXLI.

[4] A New Coal Calorimeter, by R. S. Carpenter. Trans. Amer. Soc. Mech. Eng., Vol. XVI, Paper DCLIII.

grams of water, oxygen gas under slight pressure being introduced into the combustion chamber through the glass tube. As the fuel burns the products of combustion pass directly through the water, imparting their heat to the water. The total rise of temperature during combustion is directly proportional to the heat liberated by the sample tested. A correction for the specific heat of the apparatus is necessary. This can best be determined by burning pure carbon in the calorimeter, which, according to Berthelot, gives up 14,646 British thermal units.

All calorimeters are liable to slight error, due to all or a part of the following conditions: (1) Inaccurate weights of fuel or water; (2) incomplete combustion; (3) radiation or absorption of heat; (4) inaccurate thermometer readings; (5) incomplete absorption of the heat of combustion by the water. Some other forms of calorimeters may be liable to other distinct errors. Some of the sources of error mentioned may neutralize each other. The form of calorimeter used by the author is not so accurate as some of the more elaborate instruments, notably Mahler's, or Berthelot's, or Carpenter's—although it gives results which are probably within a small percentage of the correct ones.

LATER TESTS MADE FOR THIS PAPER.

In making these later tests it seemed desirable to determine the heat of combustion of corn on the ear, and also of the grain and cob separately, both of yellow dent and of white dent corn. The various samples were ground as fine as possible, and were then burned in the calorimeter. Each kind of corn was tested from two to five times, to insure more accurate results. The principal difficulty experienced by the author in making these calorimeter tests was to secure complete combustion of the sample. The combustion at times proceeded with explosive violence (once the calorimeter was blown up), and small unconsumed particles of the corn were probably blown out. The samples of cob were the most troublesome of all. In view of this difficulty to secure complete combustion, it seemed desirable to take the highest reading in the various series of tests as the correct one, rather than to assume that the average of all readings would most nearly represent the actual heat of combustion. This seems the more desirable, because in nearly every case the thermometer reading was highest when the rate of combustion was slowest; that is, when there were fewer explosions.

Proximate analyses were made by the author as follows, to determine the percentages of moisture and ash in the corn and in the cob:

Proximate analyses of corn and of cob.

Kind of material.	Moisture.	Volatile matter.	Fixed carbon.	Ash.
Yellow dent:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Corn	8.45	78.10	12.18	1.27
Cob	8.00	75.97	14.68	1.35
White dent:				
Corn	8.88	77.22	12.90	1.00
Cob	7.38	77.65	13.73	1.24

From the results of the calorimeter trials and from the proximate analyses the following table of the heating value of corn is calculated, the figures all being British thermal units. The marked difference between the heat of combustion in the earlier and later trials is due to the greater percentage of moisture in the samples used in the earlier trials:

The heating value of corn.

Kind of material.	Heating value in British thermal units.		
	Per pound of air-dry material.	Per pound of water-free material.	Per pound of dry combustible material.
Yellow dent:			
Corn and cob	8,040		
Corn	8,202	8,959	9,085
Cob	7,214	7,841	7,958
White dent:			
Corn and cob	7,841		
Corn	8,382	9,199	9,301
Cob	7,571	8,174	8,285

In the following table are collected a few of the results of calorimeter tests of coal, made by several different authorities. Taking the heating value of yellow dent corn on the ear as 8,040 British thermal units, the ratio of the heat of combustion of the coal to that of the corn is given in column 4. Column 5 gives the present cost of nut coal per ton (undelivered) in Lincoln, and column 6 gives the cost of corn per bushel (70 pounds) to equal the cost of coal. Lump coal runs from 50 cents to $1 per ton more than the nut.

Heating value of different kinds of coal, as compared with that of corn.

Locality.	Authority.	British thermal units per pound of coal.	Ratio of coal to corn.	Value of coal per ton, in Lincoln.	Cost of corn per bushel to equal coal.
					Cents.
Pocahontas, Va	Barrus *a*	14,121	1.76	$8.60	15.0
George Creek, Md	do	13,656	1.70		
Lackawanna anthracite	do	11,104	1.38	8.00	20.3
Scranton	Carpenter *b*	12,903	1.60	8.00	17.5
New Blossburg, Pa	do	13,528	1.68	7.60	15.8
Buckhart, Ill	Forsyth *c*	10,259	1.27		
Bryant, Ill	do	9,940	1.23		
Canton, Ill	do	10,945	1.36		
Claire, Ill	do	9,988	1.24		
Cuba, Ill	do	11,370	1.41		
Dunfermline, Ill	do	10,471	1.30		
Edwards, Ill	do	10,945	1.36		
Elmwood, Ill	do	8,820	1.09		
Streator, Ill	do	11,400	1.41		
Hiteman, Iowa	do	8,955	1.11	3.10	9.8
Keb, Iowa	do	11,476	1.43	3.10	7.6
Flaglers, Iowa	do	10,684	1.31	3.10	8.3
Chisholm, Iowa	do	11,370	1.41	3.10	7.7
Mendota, Mo	do	11,447	1.42	4.60	11.3
Hamilton, Mo	do	12,645	1.57		
Lingo, Mo	do	12,007	1.49		
Rock Springs, Wyo	Colburn *d*	12,838	1.60	6.25	13.7
Hopkins, Wyo	do	13,244	1.65	6.25	13.3
Cambria, Wyo	do	11,819	1.47		
Hanna, Wyo	do	11,563	1.44	5.25	12.7
Sheridan, Wyo	do	10,301	1.28		
Redcanon, Wyo	do	11,412	1.42	6.25	15.4

a Trans. Amer. Soc. Mech. Eng., Vol. XIV, Paper DXLI.
b Trans. Amer. Soc. Mech. Eng., Vol. XVI, Paper DCLIII.
c Engineering News, January 17, 1895.
d Special Bulletin, University of Wyoming, January, 1895.

From the preceding table it will be seen that 11,500 British thermal units per pound of coal is not far from the average heating value of the coals in use in Nebraska. Assuming this value, and again taking the heating value of yellow dent corn on the ear as 8,040 British thermal units, the following table is computed, showing the cost of corn per bushel to equal that of coal, selling at different prices:

Corn per bushel.	Coal per ton.
Cents.	
4.9	$2.00
6.1	2.50
7.3	3.00
8.5	3.50
9.8	4.00
11.0	4.50
12.2	5.00
13.4	5.50
14.7	6.00
16.0	6.50
17.1	7.00
18.3	7.50
19.5	8.00

THE HEATING VALUE OF ALCOHOL.

In many cases liquid fuels are somewhat more desirable than solid fuels, on account of the absence of ash and smoke, and the greater ease of regulation of combustion. Alcohol, the liquid distillate of corn, is admirably adapted for a fuel, could it be produced cheaply enough to be used in that way. The heat of combustion of alcohol is given by Professor Carpenter[1] as 12,700 British thermal units per pound, and by Professor Cooke[2] as 12,931 British thermal units. A certain amount of heat produced by the combustion of alcohol would probably be more economically used than a like amount of heat produced direct from the corn, since it could be burned in such a way as to turn a greater number of heat units into useful work than with the solid fuel.

A personal letter from Mr. W. F. Fahs, secretary of the Willow Springs Distillery, of Omaha, states that 1.64 pounds of corn will yield, by their process (an electrical one), 1 pound of alcohol. The Government estimates that 1 bushel of corn (56 pounds) will produce 33¼ pounds of alcohol, or about 1.7 pounds of grain for each pound of alcohol. In assessing the output of a bushel of corn, however, the Government makes an allowance of 20 per cent from this amount for poor grain, accidents, etc., and taxes must be paid upon this basis, even if the output be less than this. If a greater output is produced, the tax must be paid upon all of the spirits.

The heating value of yellow dent corn is 8,202 British thermal units, or 1.7 pounds of corn will liberate 13,943 British thermal units, which is 1,012 British thermal units more than would be given up by the alcohol produced from the corn. This loss could be partially regained by burning the refuse from the process of distillation. Seven pounds of alcohol constitutes 1 gallon, which costs, if the duty be taken off, from 40 to 50 cents. It is thus evident that its cost will prevent the more extensive use of alcohol as fuel. It is interesting to note that a modified form of Dulong's law for the heat of combustion, $H_c = 14646\ [C + 3.67\ (H - O/8)]$, where H_c is the heat of combustion, C is the weight of carbon, H is the weight of hydrogen, and O is the weight of oxygen, gives a value for H_c of 13,334 British thermal units, which is but 3 per cent greater than the value as given by Professor Cooke. The formula of alcohol was taken as C_2H_6O.

CONCLUSIONS.

From the experience of the author in conducting the boiler test of corn, it is doubtful whether it would be a practicable fuel for the generation of power, unless it was burned in some special furnace that would insure the perfect combustion of the volatile matter, which forms so large a percentage of the whole corn, and which is driven off at a comparatively low heat. Some form of automatic stoker would also be desirable, since the corn burns very rapidly and must be frequently fired, making the work of the fireman very arduous, and at the same time tending to cause incomplete combustion by the excess of cold air entering through the fire door.

Undoubtedly corn may at times be a cheap and economical fuel for domestic use. It is cleaner and more easily handled than coal, and contains but a very small amount of ash. It burns rapidly with an intense heat, which is apt to be destructive to the cast-iron linings of the stove. Here again some special form of fire box, that will not be injured by the heat, and that will utilize as much of the heat as possible, should be used. If the rate of combustion be too great much of the heat will pass up the chimney.

It is interesting to note that an acre of land will produce from 40 to 80 bushels of corn, which, if burned, will yield from 22,512,000 to 45,024,000 British thermal units, not counting the heat that could be obtained from the stalk. Since a ton of good coal will give up from about 20,000,000 to 26,000,000 British thermal units, an acre of ground is each year capable of producing fuel which is equal to 0.87 or 1.28 to 1.74 or 2.56 tons of coal. The stalk will probably increase this amount by one-fourth or one-third. At some future time the heat that can be produced by an acre of ground will probably be of great economical importance.

The paper was much appreciated and called forth an interesting discussion participated in by every member present.

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[1] Experimental Engineering, by Prof. R. C. Carpenter.
[2] Elements of Chemical Physics, by Prof. Josiah P. Cooke.

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